

United States
Circuit Court of Appeals
For the Ninth Circuit.

WILSON & WILLARD MANUFACTURING
COMPANY, a Corporation,

Appellant,

vs.

UNION TOOL COMPANY, a Corporation, ED-
WARD DOUBLE, ROSA EICHENHOFER,
as Administratrix of the Estate of FRIED-
RICH EICHENHOFER, Deceased, and
GEORGE L. CHADDERDON,

Appellees.

BOOK OF EXHIBITS.

Upon Appeal from the United States District Court
for the Southern District of California,
Southern Division.

INDEX TO THE PRINTED TRANSCRIPT OF RECORD.

[Clerk's Note: When deemed likely to be of an important nature, errors or doubtful matters appearing in the original certified record are printed literally in italic; and, likewise, cancelled matter appearing in the original certified record is printed and cancelled herein accordingly. When possible, an omission from the text is indicated by printing in italic the two words between which the omission seems to occur.]

	Page
Designation Under Rule 23	297
EXHIBITS:	
Complainants' Exhibit A. Willard U. S. Patent 762,458	20
Complainants' Exhibit Blakeslee, Letter of February 3, 1913	25
Complainants' Exhibit Blue-Print of Oil Well Supply Co. Canadian Under- Reamer, 1902	97
Complainants' Exhibit Cummings Patent..	90
Complainants' Exhibit Double Patent— No. 734,833	1
Complainants' Exhibit Double Patent 796,197	7
Complainants' Exhibit Double Patent No. 862,317	28
Complainants' Exhibit Jones or Improved North Patent	14
Complainants' Exhibit Wilson File Wrap- per and Contents	34
Defendant's Exhibit Certified Copy of File Wrapper and Contents of O'Donnell & Willard U. S. Patent No. 762,435.....	112

	Index.	Page
EXHIBITS—Continued:		
Defendant's Exhibit Certified Digest of Patent Office Records—Re Brown Patent		287
Defendant's Exhibit Certified File Wrap- per and Contents Double Patent in Suit		227
Defendant's Exhibit Hobart & Ahearn U. S. Patent No. 439,275		199
Defendant's Exhibit Letter J. O. Dart to Edward North of March 15, 1902.....		273
Defendant's Exhibit Letter of March 19, 1902, Martin Barber to Edward North.		274
Defendant's Exhibit O'Donnell & Willard Patent		98
Defendant's Exhibit Page 80, Oil Well Sup- ply Co.'s Catalog of 1900.....		269
Defendant's Exhibit Page 82, Oil Well Sup- ply Co.'s Catalog of 1900		270
Defendant's Exhibit Page 117, Oil Well Supply Co.'s Catalog of 1900.....		271
Defendant's Exhibit Photograph of Califor- nia Oil Well Rig Showing Calf-wheel, Bull-wheel, Wire Rope and Top of Casing in Hole, the Casing Shown Be- ing Heavy Casing Weighing not Less Than 54 Pounds to the Foot		275
Defendant's Exhibit Specifications of U. S. Brown's 687,296		283
Defendant's Exhibit Swan Patent 683,352..		105
Defendant's Exhibit Union Oil Tool Com- pany's Circular of North Improved Underreamer		226

Index.

Page

EXHIBITS—Continued:

Defendant's Exhibit U. S. Allen Patent No. 294,302	213
Defendant's Exhibit U. S. Carruthers Patent No. 479,933	217
Defendant's Exhibit U. S. Day Patent 403,877	152
Defendant's Exhibit U. S. Deisch Patent No. 526,440	204
Defendant's Exhibit U. S. Duncan Patent No. 662,895	222
Defendant's Exhibit U. S. Kellerman Pat- ent No. 679,384	167
Defendant's Exhibit U. S. Lloyd Patent No. 344,744	194
Defendant's Exhibit U. S. Mack Patent No. 492,371	156
Defendant's Exhibit U. S. North Patent No. 674,793	162
Defendant's Exhibit U. S. Mentry Patent No. 647,605	186
Defendant's Exhibit U. S. Patent to Mack No. 496,317	176
Defendant's Exhibit U. S. Patent to Palm No. 563,054	181
Defendant's Exhibit U. S. Plotts Patent No. 668,340	265
Defendant's Exhibit U. S. Sullivan Patent No. 79,276	190

EXHIBITS—Continued:

Defendant's Exhibit U. S. Yorke Patent	
No. 475,913	208
Defendant's Exhibit Wilson Underreamer	
Patent	277

Complainants' Exhibit Double Patent.

[Endorsed]: U. S. District Court, Southern District of California, Southern Division. Union Tool Co. et al., Compls., vs. Wilson & Willard Mfg. Co. Exhibit Complainants' Exhibit Double Patent. Filed Nov. 1, 1912. Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Complainants' Exhibit Double Patent. Filed May 8, 1917. F. D. Monekton, Clerk.

No. 734,833.

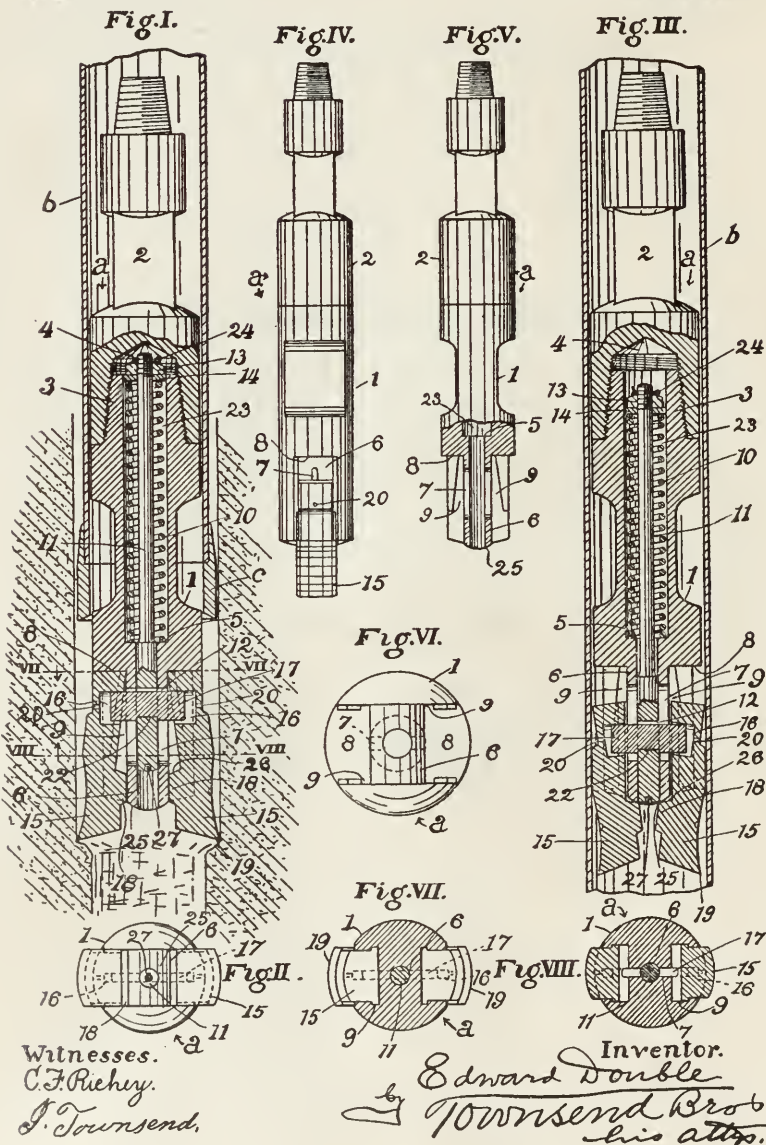
PATENTED JULY 28, 1903.

E. DOUBLE.
UNDERREAMER.

APPLICATION FILED OCT. 26, 1901.

NO MODEL.

2 SHEETS—SHEET 1.



No. 734,833.

PATENTED JULY 28, 1903.

E. DOUBLE.
UNDERREAMER.

APPLICATION FILED OCT. 26, 1901.

NO MODEL.

3 SHEETS-SHEET 2

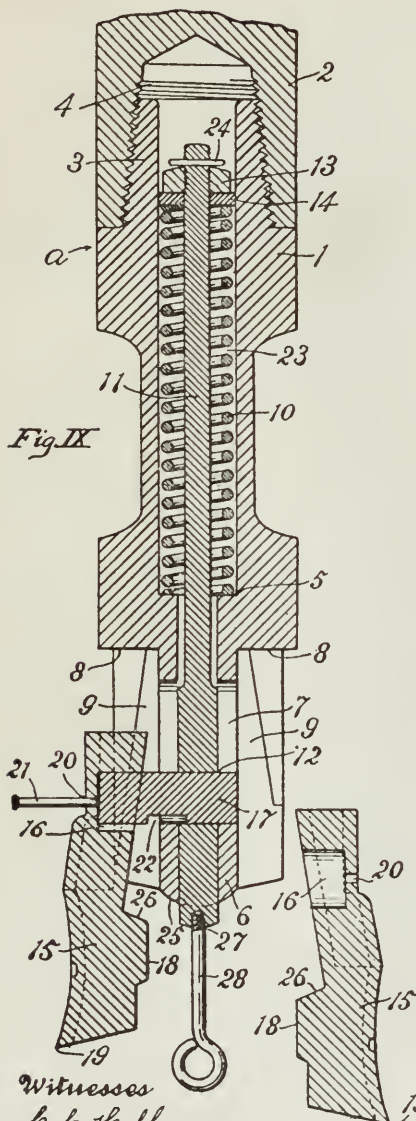


Fig IX

Fig X

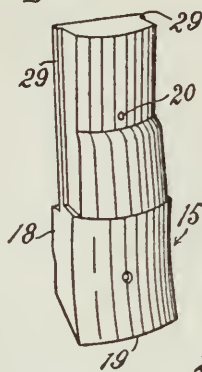


Fig XI

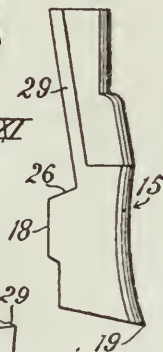
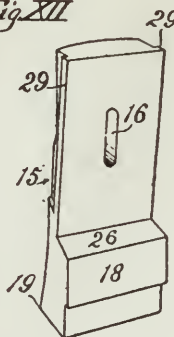


Fig XII



Witnesses
C. C. Holly
J. Townsend.

Inventor
Edward Double
by Townsend Bros
his atty.

UNITED STATES PATENT OFFICE.

EDWARD DOUBLE, OF SANTA PAULA, CALIFORNIA.

UNDERREAMER.**SPECIFICATION** forming part of Letters Patent No. 734,833, dated July 28, 1903.

Application filed October 26, 1901. Serial No. 80,144. (No model.)

To all whom it may concern:

Be it known that I, EDWARD DOUBLE, a citizen of the United States, residing at Santa Paula, in the county of Ventura and State of California, have invented a new and useful Underreamer, of which the following is a specification.

An object of this invention is to provide an underreamer which is easily constructed, effective in action, and will not be liable to any breakage or loss of parts while in operation.

My invention includes the novel underreamer and the combinations and parts hereinafter described and claimed and is capable of being carried out in various ways.

The accompanying drawings illustrate my invention.

Figure I is a view partly in vertical mid-section of an underreamer in operation below a well-casing, a portion of which is shown. Fig. II is a plan of the lower end of the underreamer with the slips in the position shown in Fig. I. Fig. III is a view of an underreamer with parts in position for passing through the casing. Portions are shown in vertical mid-section. A fragment of the casing is shown in axial section. Fig. IV is an elevation of the underreamer intact viewed from the right of Fig. III. Fig. V is an elevation of the underreamer-mandrel viewed from the right of Fig. IV, portions being broken away to expose the inner construction of the lower part of the mandrel. Fig. VI is an enlarged plan of the lower end of the underreamer-mandrel inverted. Figs. VII and VIII are sections on lines indicated by VII and VIII, respectively, in Fig. I, looking in the directions of the arrows, respectively. Fig. IX is an enlarged mid-sectional detail to illustrate the manner of applying or taking off the slips. Figs. X, XI, and XII illustrate one of the slips from different points of view.

a designates a hollow mandrel desirably constructed of a hollow body 1 and a joint member 2 screwed thereon, the hollow body 1 being furnished at its upper end with a screw-threaded pin 3 to screw into the socket 4 in the lower end of the joint member 2. The hollow mandrel is furnished with an internal shoulder 5, a downward extension 6, with oppositely-arranged parallel bearing-faces having a keyway 7 therein, shoulders 8 at the

sides of such extension, and upwardly and inwardly sloping tapering dovetail slipways 9 beneath said shoulders.

10 designates a spring on the shoulder 5 in the hollow mandrel.

11 designates a rod playing up and down in the mandrel and furnished with a keyseat 12 and supported by the spring 10. Preferably the rod 11 is furnished with a nut 13, screwed on its upper end, to be upheld by the spring 10.

14 designates a washer between the nut and the spring.

15 designates tilt-slips slidingly connected with the mandrel and playing in the slipways 9 and furnished with key-seats 16, respectively.

17 designates a key in the key-seats of the slips and rod and playing in the keyway 7 of said extension and upheld by the spring-supported rod 11 to hold the slips against the shoulders 8.

The sockets or key-seats 16 are somewhat larger than the key 17 to permit the slips 15 to partake of a tilting action, the key 17 thus forming a portion on the rod 11, on which the tilt slips or bits 15 are loosely swung or pivoted, adapting their lower ends to tilt or swing in toward the center of the stock or mandrel portion to pass through the well-casing or to tilt away from the center to assume the proper position for reaming. The tilt-slips are provided with shoulders 18, adapted to slide upon a spreading portion provided in connection with the mandrel-body. Said slips are furnished with inward projections 18 to slide upon the downward extension 6 of the mandrel to spread apart the cutting edges 19 of the slips when the slips are drawn up. The slips 15 are slidingly mounted on opposite sides of the downward-extending portion of the mandrel, and the key-seats 16 thereof are on the inner faces of the slips, respectively, and are practically closed at their outer ends, thus to exclude any mud or other foreign materials when the underreamer is in operation.

20 designates small holes in the slips, respectively, to allow a punch 21 to be inserted for adjusting the key in the operation of applying or taking off the slips. The key is preferably a notched key, being provided in

734,833

2

its lower edge with a notch 22, so that when the key is in place in its seat 12 the walls of the notch will engage the rod 11, thus to guard against displacement of the key from the position shown in Figs. I and III. The spring 10 affords yielding means for constantly holding the rod 11 up in the notch 22 and to hold the slips 15 against the shoulders 8, the parts of the underreamer being constructed to allow the key to be inserted through the rod 11 into the key-seat of a slip only when the slips and rod are drawn down with the key-seat 12 of the rod flush with the bottom of the keyway 7 in the mandrel. For this purpose the tapering dovetail slipways 9 open laterally just above the plane of the lower end of the bottom of the keyway 7 in the extension to allow the key 17 to be inserted in the key-seats 12 and 20 only when said seats are flush with the lower end of the keyway 7 and the slip drawn out as far sideways as it can be drawn, as shown in Fig. IX.

To assemble the parts of the underreamer in the first instance, the hollow body 1 being unscrewed from the joint member 2, the spring 10 will be inserted into the chamber 23 of the mandrel to rest on the shoulder 5 therein, and the slip-carrying rod 11 will be inserted into place and the washer 14 and nut 13 adjusted, as shown in Fig. I. The nut is preferably held from unscrewing by means of a cotter-pin 24 passed through the rod 11 after the nut has been screwed home. The rod is then forced or pulled downward by any suitable means into the position shown in Fig. IX, thus bringing the bottom of the key-seat 12 flush with the bottom of the slot 7 in the extension 6 of the mandrel. Then one of the slips is applied in position, with its key-seat 16 ready to receive the key 17, when the same is inserted through the key-seat 12 and the slot 7. Then the key is inserted and is passed through the key-seat of the rod sufficiently far to allow the other slip to be brought into position, so that the key may be pushed back into the key-seat of said other slip. Then a suitable instrument, such as the punch 21, will be inserted through the hole 20 and the key will be pushed back into the key-seat of the slip last applied, whereupon the notch 22 will be brought into position to receive the lower wall of the key-seat 12. Then the rod 11 is released, thus allowing the yielding means 10 to draw the rod up into the mandrel, thus bringing the slips 15 up against the shoulders 8 and the inward projections 18 against the sides of the downward extension 6, thereby spreading apart the lower ends of the slips.

The face 25 of the lower end of the downward extension 6 of the mandrel is upwardly sloping at its edges and the upper faces 26 of the extensions are downwardly sloping, so that when the slips are drawn upward they are readily forced outward by the sliding contact of the sloping faces 25 and 26.

By the construction shown wherein the hollow mandrel is provided at its upper end with

a pin screwed into the lower end of the joint member 2 great strength of the hollow mandrel is insured.

In Fig. I, *b* designates the well-casing and *c* the usual shoe at the bottom of such casing.

In order to conveniently remove and reapply the slips for the purpose of sharpening or for any other purpose, the lower end of the rod 11 is furnished with a screw-threaded socket 27, and means for drawing down the rod against the pressure of the spring 10 are temporarily screwed into the socket to enable the operator to bring the rod 11 into position to allow the slips to be removed and replaced without unscrewing the body of the mandrel from the joint member.

The eyebolt 28 (shown in Fig. IX) indicates a form of such means.

To remove the slips, the rod will be drawn down into the position shown in Fig. IX, thus bringing the key against the lower end of the keyway 7 in the extension 6 and allowing the rod to be drawn out of engagement with the notched edge of the key 17, whereupon a suitable instrument, such as the punch 21, will be inserted into the hole 20 and the key driven into the position substantially shown in Fig. IX, thus releasing one of the slips, whereupon the punch 21 will be inserted into the hole 20 in the other slip and the key will be driven out of the key-seat 16 in said other slip, thereby releasing the other slip.

To replace the slips, the operation just described will be reversed.

When the slips have been replaced, the rod will be released and the eyebolt unscrewed and the apparatus is ready for use.

29 designates the dovetail flanges of the slips to play in the ways 9.

To introduce the underreamer into the well-casing, the slips will be tilted and drawn down into the position shown in Fig. III, thus bringing the projections 18 below the extension 6, whereupon the edges 19 are brought toward each other sufficiently to allow the tool to pass down through the casing, and when the slips escape below the shoe *c* the spring 10 draws up the rod 11, which tilts the slips into cutting position, as indicated in Fig. I. When the tool is drawn upward, the slips coming into contact with the shoe will be tilted and pressed into the position shown in Fig. III and will readily pass out through the casing.

The rounded end 25 of the extension 6 when pressed against the abrupt projections 18 causes a quick tilting of the slips to throw their cutting edges outwardly, and the slips are thus brought into position with a comparatively slight longitudinal movement.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. An underreamer comprising a hollow mandrel furnished with an internal shoulder, a downward extension having opposite parallel bearing-faces having a keyway therein, shoulders at the sides of such extension, and upwardly and inwardly sloping dovetail slip-

ways beneath said shoulders; a spring on the shoulder in the hollow mandrel; a rod playing in the mandrel furnished with a key-seat and supported by the spring; dovetail tilt-slips playing in the slipways and furnished with key-seats respectively; a key in the key-seats of the slips and rod and playing in the keyway of said extension to hold the slips against the shoulders; said slips being furnished with inward projections to slide upon the downward extension of the mandrel to spread apart the cutting edges of the slips when the slips are drawn up.

2. An underreamer furnished with a mandrel having a downward extension provided with opposite parallel bearing-faces and a keyway in the extension; a spring-supported rod furnished with a key-seat and playing up and down in the mandrel; tilt-slips slidingly connected with the mandrel and furnished with inward projections to slide upon the opposite bearing-faces of the downward extension to spread the slips apart at the lower ends when the slips are drawn up; and a key carried by the rod and carrying the slips.

3. In an underreamer, the combination of a mandrel; slips slidingly mounted on opposite sides of a portion of said mandrel and furnished on their inner faces respectively with key-seats, said key-seats being somewhat larger than the key on the operating-rod; a yieldingly-supported rod playing lengthwise of the mandrel and furnished with a key-seat; and a notched key in the key-seats of the rod and slips, a portion of said rod taking into the notch of said key.

4. A mandrel furnished with shoulders and a slotted extension beyond said shoulders and with dovetail ways on opposite sides of said extension; dovetail tilt-slips for said ways furnished on their inner faces respectively with key-seats; a rod sliding in said mandrel and furnished with a key-seat; a notched key in the key-seats of the slips and rod; a portion of said rod taking into the notch of said key, and yielding means to draw the rod up; the parts being constructed to allow the key to be inserted through the rod into the key-seat of a slip only when the slip and rod are drawn down with the key-seats thereof flush with the bottom of the keyway in the mandrel.

5. In an underreamer, dovetail tilt-slips furnished with key-seats respectively on their inner faces; a rod furnished with a key-seat; a key for said key-seats; a mandrel in which the rod plays constructed with a slotted extension and tapering dovetail slipways which open laterally just above the lower end of the bottom of the slot in the extension, to allow the key to be inserted in the slot and key-seats only when the key-seats are flush with the lower end of the slot.

6. In an underreamer, a mandrel furnished with a hollow slotted extension, the lower end of which slopes upward at the edges; tilt-slips slidingly connected with the mandrel and furnished on their inner faces with projections, the upper-faces of which slope downward to slide upon the extension of the mandrel; and means connecting the slips with the rod.

7. In an underreamer, the combination with a hollow mandrel, provided with a slotted extension, a spring-actuated slip-operating rod provided with a pivot-key, tilt-slips provided with key-seats adapted to be engaged by said pivot-key, said key-seats being somewhat larger than the key to allow the slips to tilt, said slips provided with inwardly-projecting shoulders, and said slotted extension provided with surfaces adapted to tilt said slips and hold the same in expanded position.

8. In an underreamer the combination of a hollow mandrel with a hollow slotted extension, said extension having opposite parallel bearing-faces, a slip-carrying rod in said mandrel, slips connected to said rod, said slips having projections which bear against said extension, said slips being provided with key-seats, a key carried by said rod, each end of the key lying in a key-seat of a slip, and the key-seat in each slip being somewhat larger than the key to allow the slips to partake of a tilting action.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Santa Paula, in the county of Ventura and State of California, this 19th day of October, 1901.

EDWARD DOUBLE,

Witnesses:

WALTER WEEKLEY,
W. F. DINGER.

Complainants' Exhibit Double Patent 796,197.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal.,
So. Div. #1540—In Equity. Union Tool Co. et al.
vs. Wilson & Willard Mfg. Co. "Complainants' Ex-
hibit Double Patent 796,197." Leo Longley, Special
Examiner. Filed Apr. 16, 1913. Wm. M. Van
Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

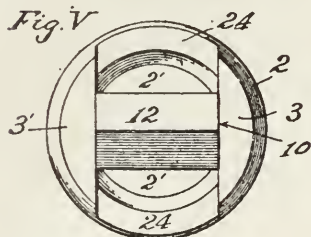
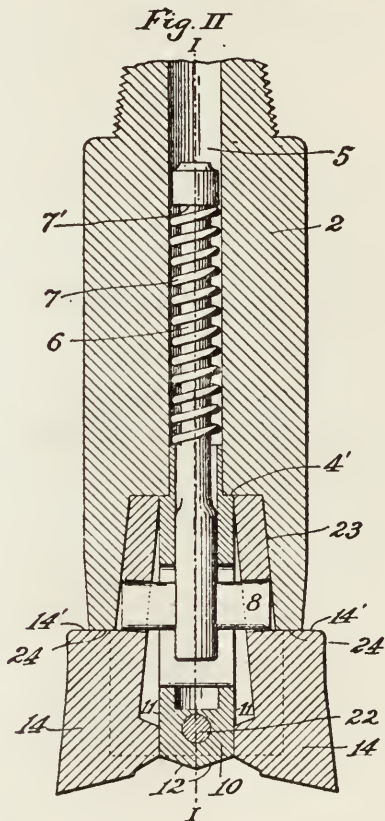
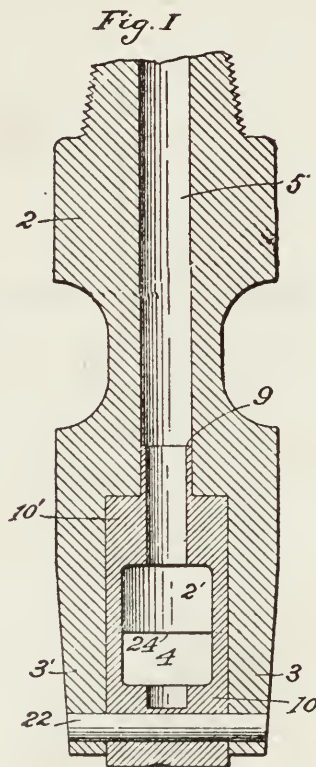
No. 2996. U. S. Circuit Court of Appeals for the
Ninth Circuit. Complainants' Exhibit Double Pat-
ent 796,197. Filed May 8, 1917. F. D. Monckton,
Clerk.

No. 796,197.

PATENTED AUG. 1, 1905.

E. DOUBLE.
UNDERREAMER.
APPLICATION FILED DEC. 18, 1902.

2 SHEETS—SHEET 1.



Witnesses
C. C. Kelly
Frederick J. Jones

Inventor
Edward Double
Townsend Bros.
his atty

No. 796,197

PATENTED AUG. 1, 1905.

E. DOUBLE.
UNDERREAMER.

APPLICATION FILED DEC. 18, 1902.

3 SHEETS-SHEET 2

Fig III

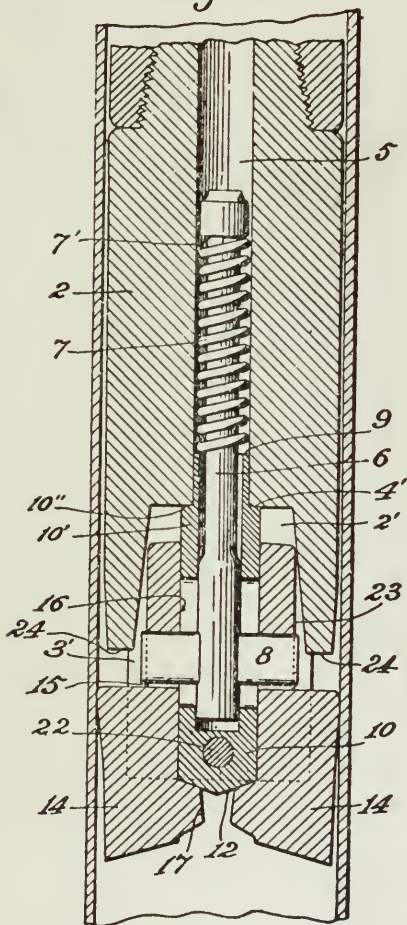


Fig. IV

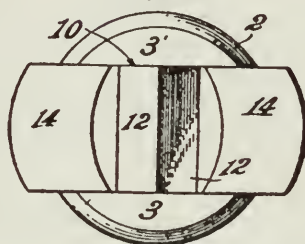
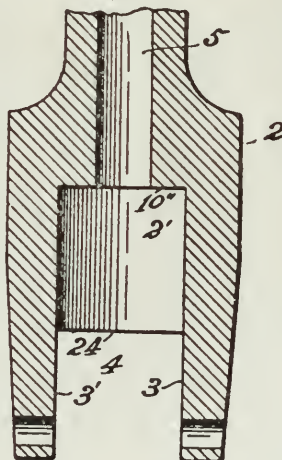


Fig. VI



Witnesses
C. B. Holly
Frederick Lyon

Inventor
Edward Double
by Townsend Burr
his atty

UNITED STATES PATENT OFFICE.**EDWARD DOUBLE, OF LOS ANGELES, CALIFORNIA.****UNDERREAMER.****No. 796,197.****Specification of Letters Patent.****Patented Aug. 1, 1905.**

Application filed December 18, 1902. Serial No. 135,792.

To all whom it may concern:

Be it known that I, EDWARD DOUBLE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to means for reaming out or increasing the bore of oil or Artesian well holes, and particularly to a device adapted to be passed through the well-casing and ream out or enlarge the bore of the well below the casing, so that the casing may be readily lowered.

The object of the invention is to provide a device of this class which shall be extremely simple and cheap in construction and positive and efficient in operation.

The invention consists generally in an underreamer comprising in combination a mandrel or body portion, said portion provided with a slotted extension having open sides and with a central bore, a removable cap or end block forming a central bar or bridge extending across the center of said slotted portion, said bar or bridge provided with lower faces downwardly and inwardly converging and forming a spreading portion, an automatic spring-actuated slip-operating rod slidably mounted in said center bore of the mandrel and provided with a key or head, and reaming-bits adapted to extend into the slotted extension through the open sides thereof and provided with key-seats into which the ends of said keys or head are adapted to engage, said key-seats being somewhat larger than the ends of the key or head to permit the bits or slips to tilt or swing thereon and said bits provided with shoulders or portions adapted to extend inwardly to contact with the converging face of said bar or bridge.

The invention consists, further, in a mandrel having a center bore, a central socket or chamber, and an open-ended open-sided hollow extension through which portions of the bits extend up into said central socket or chamber and bear against the inner walls thereof; further, in utilizing the wall portions forming the upper ends of said side slot as abutting surfaces against which shoulders on the bits are adapted to bear.

The invention consists, further, in the constructions and combinations of parts herein-after described, and particularly pointed out in the claims and will be more readily understood by reference to the accompanying draw-

ings, forming part of this specification, in which—

Figure I is a longitudinal sectional view of an underreamer embodying my invention, taken on line 11 of Fig. II, the reaming-bits having been removed, the end block or bridge being shown in place. Fig. II is a longitudinal sectional view thereof as the same appears when ready for underreaming. Fig. III is a similar view as the same appears as the tool passes through the casing. Fig. IV is an under side view showing the bits in the position of Fig. II. Fig. V is an under side view, the bits having been removed. Fig. VI is a partial longitudinal sectional view similar to Fig. I, showing the end block or bridge removed.

As shown in the drawings, 2 represents the mandrel or body portion, which is provided with a central socket or chamber 2' and with a slotted extension having the walls 3 3' and open-sided slot 4. The body portion 2 is also provided with the central bore 5, in which the slip operating and carrying rod 6 is adapted to slide. This rod is encircled by a coiled spring 7, one end of which bears against the shoulder or spring-seat 7' on the rod 6, the other end bearing against the upper end of the end block 10. It is thus seen that the rod 6 is normally held in a raised position. The rod 6 is provided with a key or head 8, either integral or detachable, as desired. The end of the slot 4 is closed by a cap or end block 10, forming a central bar or bridge, having parallel sides 11 and downwardly and inwardly converging or tapered faces 12 12'. As shown, this end block 10 is provided with abutting against the shoulder 10". The portion within the central bore 4, the shoulder 10' abutting against the shoulder 10". The portion 10 is cut away at its center in a long slot thus forming an unobstructed open-sided chamber in which the key or head 8 and the bits play. This end block 10 is secured to the end of the walls 3 3' by a pin or key 22.

14 14 represent the reaming bits or tools. The bits are each provided with a key-seat or socket 15, an inner inclined face 16, and an inward projection, surface, or shoulder 1' 1'. The key-seats or socket 15 are somewhat larger than the ends of the key or head 8.

The operation is as follows: The device being in the position shown in Fig. III, as passing through the casing, as soon as the bit passes out the end of the casing the rod 6 is forced upward by the tension of the spring

and the reaming-bits drawn upward. The shoulders or portions 17 of the bits ride, up the inclined faces of the spreading bar or end block 10, the key seats or sockets 15 permitting the bits to tilt on the key or head 8. The shoulders or surfaces 17 being brought up onto the straight sides of the bar or end block 10, the bits are held expanded. When it is desired to withdraw the underreamer from the well-hole, as the tool is raised the outer surfaces of the bits strike against the shoe of the well-casing, the rod 6 being thereby drawn down against the tension of the spring. As soon as the shoulders or surfaces 17 pass downward far enough on the sides 11 of the central bar or bridge 10 to reach the tapered surfaces 12 the bits will tilt until they are again in the position shown in Fig. III, when they pass freely through the casing.

I make the key seats or sockets 16 somewhat larger than the ends of the key or head 8, so that the lower ends of the bits or slips may tilt away from the bar or bridge 10 in expanding or tilt toward such bar or bridge when the shoulders or surfaces 17 pass downward far enough to slide inward on the converging spreading faces 12 of the bar 10.

It will be noted that the upper ends of the bits come within the socket or chamber 2', and when in position for reaming the outer faces 23 of the bits engage the inner surfaces of the chamber-walls, and the shoulders 14' of the bits or slips contact with the portions 24 of the mandrel. The portions 24 thus form abutting surfaces for the shoulders 14' of the reaming-bits. It will also be noted that the sides of the bits bear against the side walls of the slot 4, the walls forming guides preventing lateral play of the bits.

Having described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an underreamer, in combination, a mandrel provided with a central bore and with an open-sided slotted extension, a removable end block or bridge adapted to be secured to the ends of said slotted extension, and having downwardly and inwardly converging faces and side bearing-surfaces, a spring-actuated slip operating rod slidably mounted in said central bore, the lower end of said rod provided with a key or head, and reaming-bits having key-seats somewhat larger than said key or head into which said key or head is adapted to extend, and said bits provided with tilting surfaces or shoulders adapted to contact with said converging faces on said central bar or bridge and to bear on said side bearing-surfaces when the bits are expanded.

2. In an underreamer, the combination, a mandrel provided with a central bore, and with an open-sided slotted extension, an end block or bridge portion and forming a central bar or bridge having spreading faces on its under side and bearing-surfaces on its sides, a spring-

actuated slip-operating rod slidably mounted in said central bore, and provided with a bit-engaging key or head, and reaming-bits provided with key-seats somewhat larger than said key or head into which said key or head is adapted to extend, said bits provided with tilting surfaces or shoulders adapted to move against said spreading faces and bear on said bearing-surfaces of said central bar when expanded and said bits provided with portions above said bearing-surfaces adapted to permit said bits to tilt inward when said rod is drawn down, so that said bits may tilt inward.

3. In an underreamer, in combination, a mandrel provided with a central bore and with an open-sided slotted extension, a removable end block or bridge secured on the ends of said slotted extension and forming a central bar or bridge having downwardly and inwardly converging faces and side bearing-surfaces, a spring-actuated rod slidably mounted in said central bore, the lower end of said rod provided with a key or head, and reaming-bits having key-seats somewhat larger than said key or head into which said key or head is adapted to extend, and said bits provided with tilting surfaces or shoulders adapted to contact with said converging faces on said central bar or bridge and to bear on said side bearing-surfaces when the bits are expanded, the width of said slips adapting the lateral faces thereof to bear against the side walls of said slotted extension thereby preventing lateral movement of the slips.

4. In an underreamer, the combination, a mandrel provided with a central bore, and with an open-sided slotted extension, a removable end block or bridge secured on said slotted extension, said end block or bridge having spreading faces on its under side and bearing-surfaces on its sides, a spring-actuated slip operating rod slidably mounted in said central bore, and provided with a bit-engaging key or head, and reaming-bits provided with key-seats somewhat larger than said key or head into which said key or head is adapted to extend, said bits provided with tilting surfaces or shoulders adapted to move against said spreading faces and bear on said bearing-surfaces of said central bar when expanded, and said bits provided with portions above said bearing-surfaces adapted to permit said bits to tilt inward when said rod is drawn down, the width of said slips adapting the lateral faces thereof to bear against the side walls of said slotted extension thereby preventing lateral movement of the slips.

5. In an underreamer, the combination with a slotted mandrel provided with a downwardly-projecting open-ended slotted or chambered extension, an end portion detachably secured thereon and provided with a central bar or bridge extending over the center of said slot and provided with spreading faces, a spring-actuated rod slidably arranged in

said slotted mandrel and having its lower end extending into the slot or chamber of said extension and provided with a key or head, and reaming-bits provided with key seats or sockets somewhat larger than the ends of said key into which said key extends, said bits provided with portions adapted to operate against said faces, and with surfaces to bear against the well-casing to tilt said bits inward and with side faces adapted to slide against the side walls of said slotted or chambered portion and prevent lateral play of the bits.

6. In an underreamer, in combination, a mandrel provided with a central bore, a chamber or socket and an open-sided slotted extension, an end block secured on said slotted extension, said end block provided with a central bar or bridge extending over the center of said slot and provided on its under side with spreading faces, a spring-actuated rod slidably arranged in said mandrel and provided with a bit-operating key or head, and reaming bits or slips provided with cutting edges and with key seats or sockets somewhat larger than the ends of said key or head, said bits provided with portions adapted to operate against said faces, and with surfaces to bear against the well-casing to tilt said bits inward.

7. In an underreamer, the combination, with a hollow mandrel, provided with a socket or chamber and with downwardly-extending walls having an open-sided slot therebetween, an end block on the ends of said walls and forming a bridge therebetween, said bridge portion provided with a wedge-shaped under surface, a spring-actuated bit supporting and operating rod slidably arranged in said hollow mandrel, and tilting bits freely, detachably and tiltingly supported on said rod and operated thereby, said bits provided with surfaces adapted to contact with said wedge-shaped under surface of said bridge, and with portions to contact with the interior of the casing when the tool is drawn up into the casing.

8. In an underreamer, the combination, of a mandrel, provided with a central bore in its upper portion and an open-ended socket or chamber in its lower portion, the lower portion of the walls of said chamber having open-ended parallel side slots, an end block keyed to the lower ends of said mandrel and forming a bridge across the ends of said slots, said block provided with spreading faces, a spring-actuated rod slidably arranged in said central bore, means on said rod for supporting and operating the bits, and bits having outer surfaces bearing against the interior of said socket or chamber, portions adapted to contact with the interior of the casing as the tool passes through the casing, and portions adapted to slide upon said spreading surfaces.

9. In an underreamer, the combination, of a mandrel provided with a central bore in its

upper portion and an open-ended socket or chamber in its lower portion, the lower portion of the walls of said chamber having open-ended parallel side slots, the walls of the upper ends of said slots forming abutting surfaces, an end block keyed to the lower ends of said mandrel and forming a bridge across the open ends of said slots, said block provided with spreading faces, a spring-actuated rod slidably arranged in said central bore, means on said rod for supporting and operating the bits, and bits having outer surfaces bearing against the interior of said socket or chamber, shoulders adapted to contact with said abutting surfaces when the bits are expanded, portions adapted to contact with the interior of the casing as the tool passes through the casing, and portions adapted to slide upon said spreading faces.

10. In an underreamer, the combination, of a mandrel, provided with a central bore, a central socket or chamber and an open-sided slotted hollow extension, having a bridge across its end, a spring-actuated slip-operating rod slidably mounted in said central bore and provided with a key or head and reaming-bits carried by said rod, portions of which bits extending up into said socket or chamber and bearing against the inner surface thereof, and said bits provided with portions adapted to operate against said bridge to expand the bits.

11. In an underreamer, the combination, of a mandrel, provided with a central bore, a central socket or chamber and an open-sided or slotted hollow extension, having a bridge across its ends, the upper end walls of the side slots forming abutting surfaces, a spring-actuated slip-operating rod slidably mounted in said central bore and provided with a key or head, and reaming-bits carried by said rod, portions of which bits extending up into said socket or chamber and bearing against the inner surfaces thereof, and said bits provided with portions adapted to operate against said bridge to expand the bits, and provided with shoulders to contact against said abutting surfaces.

12. In an underreamer, in combination, a hollow mandrel, provided with a slotted extension, a spring-actuated rod slidably arranged therein and provided with a head or key, an end block or bridge keyed to the projecting ends of said slotted extension, said end block provided with under spreading faces and side bearing portions, and reaming-bits carried on said head or key, said bits provided with portions adapted to contact with said spreading faces and said bearing portions and with portions adapted to contact with the interior of the casing as the tool passes there-through.

13. In an underreamer, the combination, of a mandrel provided with a central bore, a central socket or chamber and an open-sided hollow extension, an end or bridge block

796,197

eyed to the projecting ends of said slotted extension and provided with under spreading faces and side bearing portions, a spring-actuated bit-operating rod slidably mounted in said central bore and provided with a key on said head, and reaming-bits carried by said rod, portions of the bits extending up into said socket or chamber and bearing against the inner surface thereof, said bits provided with portions adapted to operate against said under spreading faces to expand the bits and said bits provided with portions adapted to contact with the interior of the casing as the tool passes therethrough.

14. In an underreamer, in combination, a hollow mandrel, provided with a slotted extension, a spring-actuated rod slidably arranged therein and provided with a head or key, an end block or bridge keyed to the projecting ends of said slotted extension, said end block provided with under spreading faces and side bearing portions, and reaming-bits carried on said head or key, said bits provided with portions adapted to contact with said spreading faces and said bearing portions, and means, contacting with the interior of the casing when the tool passes therethrough, holding the bits in contracted position.

15. In an underreamer, in combination, a

mandrel provided with a central bore, a slotted extension, and a central chamber, a spring-actuated rod slidably arranged in said central bore and provided with a key or head, an end block or bridge keyed to the projecting ends of said slotted extension, said end block provided with under spreading faces and side bearing portions, and reaming-bits carried by said head, said bits provided with portions adapted to contact with said spreading faces and bearing portions, with portions adapted to contact with the interior of the casing as the tool passes therethrough, with portions extending up into said socket or chamber and bearing against the inner surface thereof, and with shoulders adapted to bear against abutments on said mandrel when expanded, said abutments formed by the wall of the mandrel connecting the legs or walls of said slotted extension.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles, in the county of Los Angeles and State of California, this 12th day of December, 1902.

EDWARD DOUBLE.

Witnesses:

FREDERICK S. LYON,

EDW. L. PAYNE.

**Complainants' Exhibit Jones or Improved North
Patent.**

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal.,
So. Div. No. 1540. Union Tool Co. et al. vs. Wil-
son & Willard Mfg. Co. "Complainants' Exhibit
Jones or Improved North Patent." Leo Longley,
Special Examiner. Filed Apr. 16, 1913. Wm. M.
Van Dyke, Clerk. By Chas. N. Williams, Deputy
Clerk.

No. 2996. U. S. Circuit Court of Appeals for the
Ninth Circuit. Complainants' Exhibit Jones or Im-
proved North Patent. Filed May 8, 1917. F. D.
Monckton, Clerk.

No. 809,570

PATENTED JAN. 9, 1906.

F. W. JONES.
UNDERREAMER.
APPLICATION FILED AUG. 30, 1904.

Fig. 1.

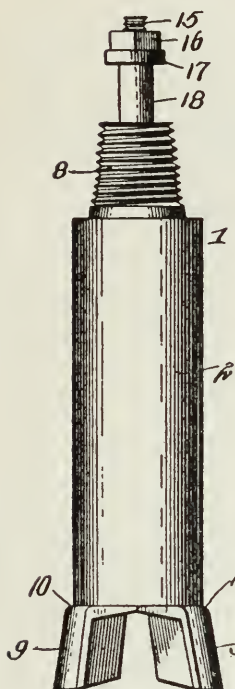


Fig. 2.

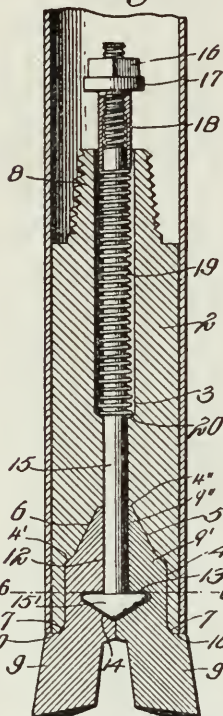


Fig. 3.

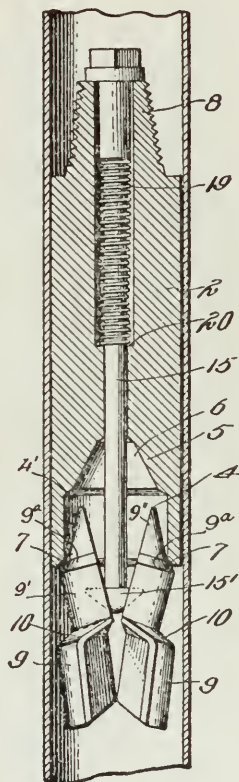


Fig. 4.

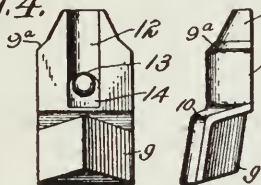
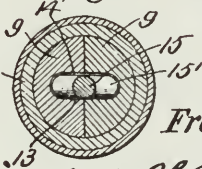


Fig. 5.



Fig. 6.



Witnesses
M. C. Lyddane
L. H. Jursbauer.

Inventor
Frederick W. Jones
by A. B. Wilson
Attorney

UNITED STATES PATENT OFFICE.

**FREDERICK W. JONES, OF SANTA PAULA, CALIFORNIA, ASSIGNOR
TO EDWARD NORTH AND EDWARD DOUBLE, OF LOS ANGELES,
CALIFORNIA.**

UNDERREAMER.**No. 809,570.****Specification of Letters Patent.****Patented Jan. 9, 1906.**

Application filed August 30, 1904. Serial No. 222,688.

To all whom it may concern:

Be it known that I, FREDERICK W. JONES, a citizen of the United States, residing at Santa Paula, in the county of Ventura and State of California, have invented certain new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to underreamers for reaming out or enlarging well-holes under well-casings in the drilling of wells, and is more particularly designed for use in the drilling of oil-wells, the object of underreaming the hole below the well-casing being to enlarge the same in order to permit the casing to be lowered farther down.

The primary object of this invention is to provide an improved device of this class which shall be of extremely simple but durable construction, composed of few parts, simple and cheap to manufacture and assemble, and which shall be positive and efficient in operation.

Other objects and ends in view will herein-after appear from the detailed description of construction and operation.

The invention consists, primarily, of a mandrel having a central bore, a spring-actuated rod slidable in said bore, said rod provided at its lower end with a suitable head, said mandrel provided at its lower end with a chamber into which said rod extends, said chamber having a lower cylindrical portion and an upper portion of less diameter, a beveled or inclined shoulder or abutment connecting said chamber portions and against which the bits or slips bear when in expanded position, and tilting slips carried on the head of said rod and provided with shanks adapted to extend within said chamber portions, and with cutting portions extending out of said mandrel into such width that when said bits are in extended position the spread of the same is greater than the diameter of said mandrel or of the well-casing, so that the hole cut by said expanded bits will be of greater diameter than the well-casing, the said bits or slips provided with beveled shoulders adapted when said bits are pulled up into said chamber by said spring-actuated rod to come in contact with said beveled abutment and cause said bits to tilt or expand.

The invention consists, further, in the con-

structions and combinations of parts herein after described, and particularly set forth in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation of an underreamer constructed in accordance with the invention. Fig. 2 is a central vertical sectional view of the same, showing the bits or slips in expanded or operative position and below the end of a well-tube. Fig. 3 is a similar view showing the bits or slips in extreme contracted position. Figs. 4 and 5 are respectively side and edge views of one of the bits or slips, sometimes called "cutters." Fig. 6 is a cross-sectional view on the line 6 6 of Fig. 2.

As shown in the drawings, 1 designates the underreamer, which consists of a suitable mandrel or body portion 2, having a central longitudinal bore 3, which bore is preferably of two diameters to provide a shoulder 20. The lower end of the mandrel of body 2 is provided with a central chamber, the lower portion 4 of which is preferably cylindrical in form and the upper portion 6 of which is in the form of a tapering socket or tapering chamber. The walls of the two chambers 4 and 6 are connected together by a beveled surface or abutment 4', which lies between the termination of the straight wall of the cylindrical chamber 4 and the inclined or conical wall of the chamber 6. The lower end of the wall of the chamber 4 is preferably beveled or inclined outwardly toward the outer edge of the body portion, as shown at 7. On the upper end of the mandrel or body portion 2 is formed a reduced tapering end 8, which is provided with screw-threads, whereby the same may be connected with the usual "sub" or string of oil-well tools.

9 represents the bits or slips, the upper portions of which when brought together conform to the shape of the chambers 4 and 6. These bits or slips are composed of the bits proper, adapted at all times to extend below the mandrel, and the shanks, adapted to extend within the mandrel. As shown, the shanks are composed of semicylindrical portions 9', the lengths of which correspond with the length of the cylindrical chamber 4,

and the semiconical portions 9', corresponding to the chamber 6. An inclined or beveled shoulder 9a is provided between the portions 9' and 9" of the bits. These inclined shoulders 9a are adapted to abut against the shoulder or abutment 4' of the mandrel when the bits or cutters are in their expanded or underreaming position. The bits are projected outward at the junction of the portions 9' and the cutting portions of the bits, so as to form shoulders 10, adapted to engage the end of the mandrel and abut thereagainst, so that the impact of the blow when the underreamer is in use is carried not only by the end 15 of the mandrel, but on the shoulders 4' and on the shoulders 4", formed at the top of the conical chamber 6, thus distributing such impact throughout the body or mandrel 2 and preventing the localization of such strain, and by thus distributing this strain the tendency of such strain to split the mandrel is reduced to a minimum.

The outer face of the bits are preferably curved or rounded, as shown, to correspond with the arc of the enlarged hole, so as to provide a rounded hole of increased diameter under the casing. The inner walls of the bits 9 are cut or beveled inwardly toward the center, thereby forming between said projecting ends when the cutters are assembled means for cutting the dirt or mud which might be caught between the collapsing bits and squeezing the same out from the sides of the cutters, so that the bits may readily collapse and be brought together. The shanks of the bits or slips 9 are provided on their inner faces with channels 12, at the lower ends of which are formed inwardly-projecting recesses 13, the lower wall of the recesses 13 being beveled or inclined upwardly and inwardly, as shown at 14, so that when the cutters or slips are brought together the channels 12 will form a cylindrical bore or passage communicating at its lower end with the circular triangular-shaped chamber formed by the recesses 13, which is provided for the reception of the head 15' of the spring-actuated rod 15.

At the upper end of the rod 15 and about the same I provide a sleeve 18, and between the lower end of this sleeve and a shoulder or abutment 20 in the body 2 is provided a coil-spring 19, which encircles or is coiled about the rod 15. The upper end of the rod 15 is threaded and adapted to receive a retaining-nut 16, provided with an annular collar or flange 17. By the adjustment of the nut 16 on the rod 15 the required compression of the spring 19 is secured, so that such spring actuates to throw the rod 15 in the position of Fig. 2 and automatically carries the bits or slips 9 into the expanded or operative position. In fact, the position of the bits shown in Fig. 2 is the normal position thereof, being the position that the same will assume when

the underreamer is not in use or has been allowed to descend through the well-casing and below the same. It will be noted that while the action of the spring 19 and rod 15 is to automatically draw the bits or slips 9 up into the chamber or socket of the mandrel and automatically expand the bits, yet none of the strain or impact on the bits while underreaming is borne by either the rod or spring, but is borne by shoulders or abutments 4' 4" and the end of the mandrel from the shoulders 10 of the bits.

When it is desired to contract the bits so as to permit of the insertion of the underreamer in the well-casing and the lowering thereof through the casing to underream below said casing, the bits 9 are drawn down into a contracted position in the usual manner and held in contracted position in the usual manner, as by a segmental ring of the ordinary construction slipped about the contracted bits and holding them from expansion while they are being inserted in the top of the casing, this segmental ring being taken off as soon as the bits are started in the casing and the cylindrical surfaces of the bits then contacting with the inner surface of the casing.

In order to prevent the edges of the bits 9 from perforating the casing during the descent of the underreamer, it is preferable to provide the cylindrical surfaces 9 with a slight pitch, so as to throw the edges of the bits away from the casing. This, however, is common in underreamer-bits. By providing the nuts 16 with an annular collar or flange 17 the downward movement of the plunger-rod 15 is limited by the engagement of said collar with the upper end of the mandrel 2, thereby preventing the engagement of the cutting members or bits 9 from the head 15' of the spring-actuated rod 15, which disengagement would result in loss of the bits in the well. It is thus seen that by the provision of tapering shoulder 4' in the chamber 4 and the provision of inclined or beveled shoulders 9a on the bits means are provided for causing the tilting of the bits from their collapsed or contracted position to their expanded or operative position.

While I do not confine myself to the use of the tapering or cylindrical sockets 6, I prefer to use the same.

Other changes in details of construction and arrangements may be resorted to without departing from the principle of my invention, and I do not limit myself to the details of construction herein shown and described.

By thus providing a tilting abutment or surface 4' within the chamber of the mandrel and providing bits or slips pivotally or tiltingly supported by the spring-actuated rod I secure the positive automatic expansion of the bits to underreaming position when the rod is permitted to slide upward in the man-

drel. This construction also permits the use of bits so constructed and of such form as to abut against the walls of the chambers of the mandrel and take all the concussion or impact (when the underreamer is in use) off of the spring-actuated rod and the pivot key or head holding the bits, thereby eliminating all danger of breaking such parts.

By making the head 15' of the spring-actuated rod 15 in the form of an arrow-head and providing in the bits or slips 9 sockets or recesses 13, corresponding in form to the wings of the arrow-head, I provide for the tilting action of the slips or bits and for a strong supporting head or pivot 15' without necessitating removal of sufficient material from the bits to weaken the same, and in the manufacture of oil-well tools great strength is essential.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An underreamer of the class described comprising a centrally-bored mandrel having a cylindrical recess in its lower end, a recess above said cylindrical recess, a beveled shoulder between said upper recess and said cylindrical recess, a rod movable longitudinally in the bore of the mandrel and having a head on its lower end and a pair of cutters recessed on their opposing inner sides to receive the lower portion of said rod and the head of said rod, each of said cutters having a semicylindrical portion of a diameter to fit in the cylindrical recess of the mandrel, a semiconical upper portion to fit in the upper recess of the mandrel, a beveled shoulder to engage the upper beveled shoulder of the mandrel, a lower portion of a diameter exceeding that of the cylindrical recess of the mandrel, a beveled shoulder between the semicylindrical portion and the said portion of enlarged diameter, the said portions of enlarged diameter having their inner opposing sides oppositely beveled to form wedge-shaped openings between them.

2. An underreamer comprising a centrally-bored mandrel having a cylindrical recess in its lower end and a recess above said cylindrical recess, a beveled shoulder or abutment between said recesses, a spring-actuated rod slidable in said central bore, said rod having a head at its lower end, tilting slips tiltingly mounted on said head, said slips provided with cutting edges and with shoulders adapted to contact with said beveled shoulder or abutment.

3. An underreamer comprising in combination a centrally-bored mandrel having a cylindrical recess in its lower end and a second and smaller recess above said cylindrical recess, an inclined or beveled shoulder or abutment being provided between said recesses, a spring-actuated rod slidable in said mandrel, said rod provided with a pivot-head

and underreaming bits of slips tiltingly mounted on said head, said bits provided with underreaming-faces and with shanks adapted to extend up into said recesses, said shanks having reduced upper portions adapted to fit within the upper recess.

4. An underreamer comprising a hollow mandrel, a spring-actuated rod slidable therein, said mandrel having at its lower end a cylindrical chamber and an inner and smaller chamber above said cylindrical chamber, an inclined or beveled abutment formed between the adjoining ends of the walls of said chambers, reaming-bits mounted on said rod and provided with surfaces adapted to contact with said inclined shoulder or abutment to tilt said bits.

5. An underreamer comprising a mandrel having a recess or chamber in its bottom and an inclined or beveled abutment in the said chamber, a spring-actuated rod slidable in said mandrel, said spring-actuated rod having a head of a form similar to an arrow-heads tilting slips or bits having sockets corresponding to the wings of said arrow-head into which said arrow-head is adapted to fit, said slips or bits provided with shanks adapted to be drawn up into said chamber and provided with inclined shoulders adapted to abut against said beveled or inclined shoulders in said chamber to tilt said slips or bits on said arrow-heads as said slips or bits are drawn inward into said chamber.

6. An underreamer comprising a hollow mandrel furnished in its lower end with a chamber provided at an intermediate portion with an inclined or beveled portion or abutment, a spring-actuated rod sliding through said chamber and extending up in said mandrel, two jaws pivoted to said rod respectively furnished at their upper ends with shanks extending above the pivot and into said chamber and furnished at their intermediate portions and above said pivot with inclined shoulders adapted to contact with said inclined abutment in said chamber.

7. An underreamer comprising a hollow mandrel furnished in its lower end with a chamber provided at an intermediate portion with an inclined or beveled portion or abutment, a spring-actuated rod sliding through said chamber and extending up in said mandrel, two jaws pivoted to said rod respectively furnished at their upper ends with shanks extending above the pivot and into said chamber, furnished above said pivot with inclined shoulders adapted to contact with said inclined abutments in said chamber, said shanks of said bits being of sufficient length to abut against the surface of the end wall of said chamber.

8. An underreamer comprising a mandrel provided in its lower end with an inwardly-extending chamber or socket, said chamber provided intermediate its length with an in-

elined or beveled abutment, a spring-actuated rod slidably mounted in said mandrel and extending through said socket or chamber up into the mandrel, two slips or bits pivoted to said rod and respectively furnished at their upper ends with shanks extending above the pivotal point to enter the upper end of said socket or chamber, said bits provided above said pivotal point with inclined shoulders adapted to abut against said inclined abutment in said socket or chamber to tilt said bits, said bits also provided with shoulders adapted to abut against the end of said mandrel.

9. An underreamer comprising a centrally-bored mandrel having a cylindrical recess in its lower side and a recess above said cylindrical recess, a shoulder or abutment between said recesses, a spring-actuated rod slidable in said central bore, said rod having a head at its lower end, tilting slips tiltingly mounted on said head, said slips provided with cutting edges and with inclined or beveled shoulders adapted to contact with said shoulders or abutment.

10. An underreamer comprising in combination a mandrel having a cylindrical chamber in its lower end and a tapering chamber above said cylindrical chamber and forming an inward extension thereof, a spring-actuated rod slidably mounted in said mandrel and extending up from said cylindrical chamber into said mandrel, reaming bits or slips tiltingly mounted on the lower end of said rod, said bits or slips having shanks extending above said lower end of said rod, said shanks having tapered upper ends corresponding to said tapered chamber, said bits or slips adapted to contact with the walls of said chambers and provided with shoulders adapted to contact with the end of said mandrel when said bits are in operative position.

11. An underreamer comprising a mandrel, a spring-actuated rod slidable therein, said mandrel having at its lower end a cylindrical chamber and an inner and smaller chamber above said cylindrical chamber, an abutment formed between the adjoining ends of the walls of said chambers, reaming-bits mounted on said rod and provided with surfaces adapted to contact with said abutment to tilt said bits.

12. An underreamer comprising in combination a mandrel having a cylindrical chamber in its lower end and a tapering chamber above said cylindrical chamber and forming an inward extension thereof, a spring-actuated rod slidably mounted in said mandrel and extending up from said cylindrical chamber into said mandrel, the end of said rod in said cylindrical chamber being formed in the shape of an arrow-head, reaming bits or slips having sockets to receive the wings of said arrow-head and tiltingly mounted thereon,

said bits or slips having shanks extending above said lower end of said rod and into said tapering chamber, the upper ends of said shanks being tapered to correspond to said tapered chamber, said bits or slips adapted to contact with the walls of said chambers and abut against the end wall of said tapered chamber and provided with shoulders adapted to abut against the end of the mandrel when in operative position.

13. An underreamer comprising a centrally-bored mandrel having a cylindrical chamber in its lower end and a recess above said cylindrical recess, a beveled or inclined shoulder or abutment formed between said recesses, a spring-actuated rod slidably mounted in said central bore, said rod having an arrow-head-shaped end in said cylindrical chamber, bits or slips having sockets corresponding to and adapted to receive the wings of said arrow-head and having shanks extending up into said cylindrical chamber and recess thereabove and provided with shoulders to abut against said abutment, said bits or slips abutting against the end wall of said recess when in operative position.

14. An underreamer comprising in combination, a mandrel, a spring-actuated rod slidable therein, said mandrel having in its lower end a cylindrical chamber and an inner and smaller chamber above said cylindrical chamber, an inclined or beveled abutment formed between the adjoining walls of said chambers, said rod provided with an arrow-head-shaped end, reaming-bits provided with sockets corresponding to and adapted to receive the wings of said arrow-head and thereby tiltingly supported on said rod, said bits provided with surfaces adapted to contact with said inclined shoulder or abutment to cause the bits to tilt.

15. An underreamer comprising a mandrel provided in its lower end with an inwardly-extending socket or chamber, said chamber provided intermediate its length with an inclined shoulder or abutment, a spring-actuated rod slidably mounted in said mandrel and extending through said socket or chamber up into the mandrel, two slips or bits pivoted to said rod and respectively furnished at their upper ends with shanks extending above the pivotal point to enter the upper end of said socket or chamber, said bits or slips provided with inclined shoulders above said pivot-point to abut against said inclined abutment in said socket or chamber to tilt said bits.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FREDERICK W. JONES.

Witnesses:

D. W. HUFFMAN,
ARTHUR H. BLANCHARD.

**Complainants' Exhibit A. Willard U. S. Patent
762,458.**

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal.,
So. Div. #1540—In Equity. Union Tool Com-
pany et al. vs. Wilson & Willard Mfg. Co. "Com-
plainants' Exhibit A. Willard U. S. Patent 762,458."
Leo Longley, Special Examiner. Filed Apr. 16,
1913. Wm. M. Van Dyke, Clerk. By Chas. N.
Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the
Ninth Circuit. Complainants' Exhibit A. Willard
U. S. Patent 762,458. Filed May 8, 1917. F. D.
Monckton, Clerk.

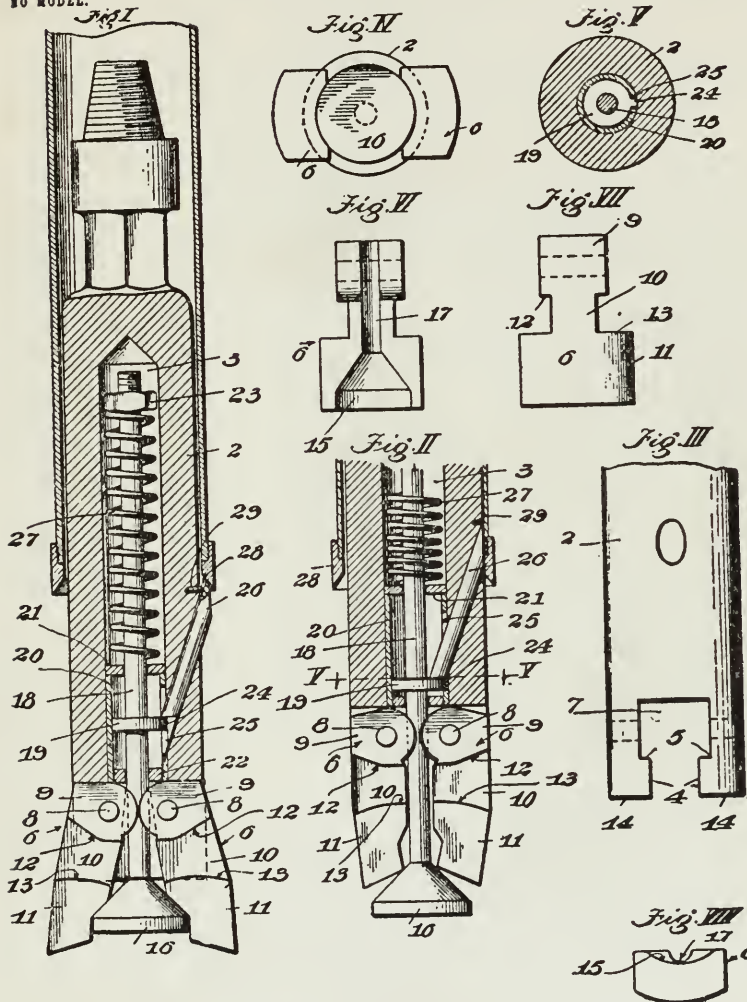
No. 762,458.

PATENTED JUNE 14, 1904.

A. WILLARD.
UNDERREAMER.

APPLICATION FILED MAY 6, 1903.

NO MODEL.



Witnesses

Edmund A. Thomas
Frederick Rhyne

Inventor

Arthur Willard

By Townsend Bros.
his attor.

UNITED STATES PATENT OFFICE.

ARTHUR WILLARD, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER.

SPECIFICATION forming part of Letters Patent No. 762,458, dated June 14, 1904.

Application filed May 5, 1903. Serial No. 155,719. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR WILLARD, a citizen of the United States of America, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Underreamer, of which the following is a specification.

My invention relates to underreamers for reaming out the holes of oil and Artesian wells, &c., larger than the casing to permit the lowering of the casing.

The general object of my invention is to provide an underreamer of exceedingly simple, cheap, and durable construction which shall be composed of few parts of such construction and interrelation as to avoid becoming displaced in the device and getting out of working order.

A further object of the invention is to provide an underreamer of the class in which the reaming-bits are pivoted upon the mandrel-body proper and are expanded by an automatically-operating wedge, the bits being so pivoted in the mandrel that the strain of underreaming is substantially taken off the pivots and borne by the mandrel-body proper.

Other and further objects and ends in view will hereinafter appear from the detail description.

The invention consists in general and specific combinations of parts and constructions, all as hereinafter described, and particularly pointed out in the claims, and will be more readily understood by reference to the accompanying drawings, forming a part of this specification, and in which—

Figure I is a longitudinal sectional view of an underreamer embodying my invention, the same being shown in connection with a section of a well-casing and in position for underreaming. Fig. II is a partial longitudinal sectional view showing the bits contracted for passage through the well-casing. Fig. III is a partial side elevation of the mandrel, the reaming-bits being removed. Fig. IV is a bottom view with the reaming-bits in expanded position. Fig. V is a plan view taken on the line VV of Fig. II. Figs VI and VII are side elevations of the reaming-bits which

1 employ. Fig. VIII is a bottom view of one of the reaming-bits.

As shown in the drawings, 2 represents the mandrel, which is provided with a central chamber 3, which extends longitudinally thereof, as shown. The lower end of the mandrel is shown best in Fig. III. This slotted portion is provided with inward projections 4 at the end of the mandrel, whereby abutments 5 are formed for the purpose hereinafter set forth. The reaming-bits 6 are pivoted within the chamber 7 thus formed above the abutments 5 by pins 8, which pass through eyes or holes in the bits and have bearings on the opposite walls of the mandrel, as indicated by dotted lines in Fig. III.

As shown in Figs. VI and VII the reaming-bits are composed of the head portion 9, the intermediate portion 10, and the blade portion 11. The intermediate portion is cut away to provide the shoulders 12, which, as shown best in Figs. I and II, have the two inclinations shown.

13 represents shoulders on the upper ends of the blade portions 11 adapted to contact or abut against the ends 14 of the mandrel. The inner sides of the bits are provided with sockets or seats 15, adapted to receive the spreader or wedge 16 when the bits are expanded, and the grooves 17 in which the stem or rod 18 rests. The stem or rod 18 is adapted to work in the chamber 3 and is provided with a shoulder or flange 19, preferably formed integral therewith.

20 represents a barrel or cylinder about the rod 18 and extending up for a portion of the length thereof. This barrel or cylinder is provided with a top plate 21 and a bottom plate 22. The top plate 21 may be formed integral with the barrel or loose or may be detachably secured on the top of the barrel, as desired. The bottom plate 22 is preferably threaded onto the bottom of the barrel. Above the barrel 20 a coiled spring 27 is interposed about the rod 18 and bears against a head 23 on the rod. This head is preferably in the form of a nut, engaging a thread on the end of the rod, and by turning the nut

down on the rod any desired tension of the spring can be secured. The wedge or spreader 16 is preferably formed integral with the rod 18 and adapted when in the position of Fig. 1 to rest on the seats 15 of the bits.

The barrel 20 is provided with a longitudinal slot and the collar or flange 19 provided with a projection 24, extending through this slot and adapted to work therein. The mandrel 2 is provided with a way 25, which extends inward from the outer surface at an acute angle, as shown, and in this way is provided a pin 26, which bears against the projection 24 and collar or flange 19 and extends when the underreamer is passing through the casing into contact with the inner surface of the casing, causing the rod 18 to be forced down, throwing the spreader or wedge 16 out of the seats 15 of the bits, so that the bits drop of their own weight into their contracted positions. The rod 26 thus forms automatic means whereby upon coming in contact with the casing the spreader or wedge is forced down against the tension of the spring 27. Toward the upper end of the pin 26 a slot 28 is provided, and a pin 29, extended out from the mandrel, is adapted to operate in this slot and prevents the pin 26 from being thrown out of the way 25 when the spring 27 forces the rod 18 up, the operating-pin 26 having passed out from the casing.

The mandrel 2 may be connected to the "sub" in the ordinary or any preferred manner.

It is seen that by making the transverse slots of greater width than the downward or vertical slots abutments 5 are provided upon which the shoulders 12 of the bits contact or bear. The pins 8 are thus relieved from the strain of the weight of the bits when the underreamer is being lowered into the casing or pulled up out therefrom.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an underreamer, in combination, a hollow mandrel having a slotted portion at its lower end, reaming-bits pivoted to said mandrel within said slotted portion, said bits provided with shoulders adapted, when in expanded position, to abut against the end of said slotted portion and extending through said slotted portion and expanding laterally there through, automatic means carried within said mandrel and adapted to normally hold said bits in expanded position, and means adapted to contact with the casing and automatically disengage said expanding means and permit said bits to contract.

2. In an underreamer, in combination, a hollow mandrel, the lower end having a downwardly and transversely slotted portion, said transverse slot being of greater width than the downward or vertical slot, reaming-bits pivoted to said mandrel and extending through said slots, said reaming-bits provided with

shoulders adapted to contact with the abutments or shoulders formed by the walls of said slots, said bits provided with shoulders adapted, when said bits are expanded, to abut against the slotted end of said portion, automatic means carried within said mandrel adapted to normally hold said bits in expanded position, and means adapted to contact with the casing and automatically disengage said expanding means and permit said bits to contract.

3. An underreamer, comprising in combination, a mandrel provided with a central bore and having a transversely-slotted lower portion, having a vertical slot of less width communicating from its lower end into said transverse slot, whereby shoulders are provided by the walls of said slot, reaming-bits pivoted to said mandrel within said transverse slot, said reaming-bits provided with portions adapted to bear upon said shoulders and with shoulders adapted, when said bits are expanded, to abut against the end of said mandrel, and means for expanding and contracting said bits.

4. An underreamer, comprising in combination, a mandrel provided with a central bore and having a transversely-slotted lower portion having a vertical slot extending inward from the end and communicating into said transverse slot, reaming-bits pivotally mounted on said mandrel within said transverse slot and provided with shoulders adapted when in position for underreaming to abut against the end of the mandrel, and means for expanding and contracting the bits.

5. An underreamer, comprising in combination, a mandrel provided with a central bore, reaming-bits pivotally mounted in the lower end of said mandrel, a rod slidably mounted in said central bore and provided with means for expanding said bits, said rod provided with a head or nut at its upper end, a barrel or cylinder about said rod and fixed in said central bore, a spring interposed about said rod and bearing against the top of said barrel and against said head or nut, and means extending through said mandrel and operating within said barrel below the top thereof and adapted to operate against said rod and adapted upon contact with the casing to force said rod against the tension of said spring to permit said bits to contract.

6. An underreamer, comprising in combination, a mandrel provided with a central bore, reaming-bits pivotally mounted in the lower end of said mandrel, a rod slidably mounted in said central bore and provided with means for expanding said bits and with a head or nut on its upper end, a barrel or cylinder about said rod and fixed in said central bore, said barrel provided with a longitudinal slot, a spring interposed about said rod and bearing upon the top of said barrel and against said head or nut on said rod, said mandrel provided with an inclined way communicating into said central bore, and an operating-pin

mounted in said way and operating upon said rod and adapted to contact with the casing to force said rod against the tension of said spring and permit the bits to contract.

- 5 7. An underreamer, comprising in combination, a mandrel provided with a central bore, reaming-bits pivotally mounted in the lower end of said mandrel, a rod slidably mounted in said central bore and provided with means
10 for expanding said bits and with a head or nut on its upper end, a barrel or cylinder about said rod and fixed in said central bore, said barrel provided with a longitudinal slot, a spring interposed about said rod and bearing
15 upon the top of said barrel and against a head or nut on said rod, said mandrel provided with an inclined way or perforation, an operating-pin mounted in said way and bearing against a portion of said rod and adapted
20 to contact with the casing to force said rod against the tension of said spring to permit the bits to contract, and means for preventing the tension of said spring throwing said operating-pin out from said way when said
25 bits are expanded.

8. An underreamer, comprising in combination, a mandrel provided with a central bore, reaming-bits pivotally mounted in the lower end of said mandrel, a rod slidably mounted

in said central bore and provided with means 3 for spreading said bits and with a head or nut on its upper end, a barrel or cylinder surrounding a portion of said rod, said rod provided with a flange or shoulder within said barrel, said barrel provided with a longitudinal slot, said flange or shoulder projecting into said slot, a spring interposed about said rod above said barrel and bearing upon the upper end or head thereof and operating against said head or nut upon said rod, said 40 mandrel provided with a perforation or way, an operating-pin in said way or perforation adapted to bear against said flange or shoulder and to contact with the casing to force said rod against the tension of said spring to 45 permit the bits to contract, and means for preventing said spring throwing said operating-pin out from said perforation or way when the bits are expanded.

In witness whereof I have hereunto set my 50 hand, this 29th day of April, A. D. 1903, in Los Angeles, in the county of Los Angeles and State of California.

ARTHUR WILLARD.

In presence of—

FREDERICK S. LYON,
GEORGE T. HACKLEY.

**Complainants' Exhibit Blakeslee, Letter of February
3, 1913.**

Phone A-3212.

Federal Court Practice
Patent Causes
Patents
Trade Marks
Copyrights

RAYMOND IVES BLAKESLEE

Lawyer and Patent Solicitor.

728-729-730 California Building

Cor. So. Broadway and Second St.

Los Angeles, Cal., Feb. 3, 1913.

Union Tool Company,

Palmetto & Mateo Sts.,

Los Angeles, Cal.

Gentlemen:

My client, Elihu C. Wilson, patentee and owner of U. S. Letters Patent No. 827,595, issued to him July 31, 1906, for Underreamers, has instructed me to again call to your attention and give you notice of the issuance to him of said Letters Patent No. 827,595; and further has instructed me to give you this notice, in addition to notice heretofore given you, that you are infringing said Letters Patent No. 827,595, in and by the manufacture, use, sale and leasing of underreamers.

My said client has further instructed me to call upon you to desist from any and all acts of infringement of said Letters Patent, and to account to him for all damages and profits for present and past in-

fringement of said Letters Patent and flowing from the manufacture, use, sale and leasing by you of any and all such underreamers.

It is further requested that you signify in the immediate future, in writing, that you will comply with the notice and demand herein made, and will respect said Letters Patent and the monopoly therein and thereby granted to my client. Unless you so signify in writing, to my client or myself within ten days Union Tool Co. #2.

from date, your failure so to do will be construed as an intention to continue said infringing acts and to refuse to comply with the notice and demand herein given and made. In the event of your failure to comply with the notice and demand herein given and made, suit will be commenced against you, and the court of competent authority will be petitioned for an injunction restraining you from further acts of infringement of said Letters Patent, and for an accounting of all profits and damages in the premises, and such further relief as may be proper.

This notice is directed to you, and to your officers, attorneys, agents, workmen and employees.

Very respectfully,

RAYMOND IVES BLAKESLEE,

RIB/DC.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. No. 1540—Equity. Union Tool Company et al., vs. Wilson & Willard Mfg. Co. “Complainants’ Exhibit Blakeslee Letter of February 3, 1913.” Leo Longley, Special Examiner. Filed Apr. 16,

1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Complainants' Exhibit Blakeslee. Ex. Letter of Feb. 3, 1913. Filed May 8, 1917. F. D. Monckton, Clerk.

Complainants' Exhibit Double Patent No. 862,317.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal. Union Tool Co. vs. Wilson & Willard Mfg. Co. Complainants' Exhibit Double Patent No. 862,317. Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Complainants' Exhibit Double Patent No. 862,317. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 862,317

PATENTED AUG. 6, 1907.

E. DOUBLE.
UNDERREAMER.
APPLICATION FILED SEPT. 10, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

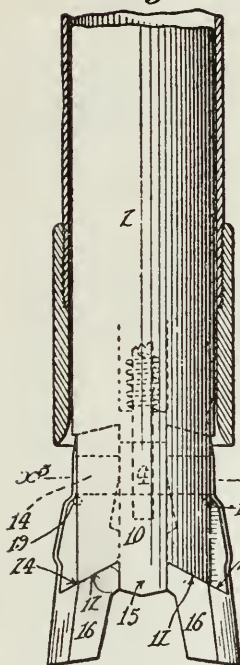


Fig. 2.

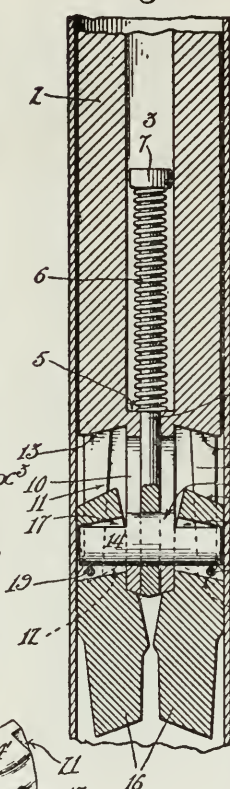


Fig. 3.

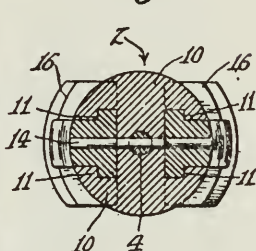


Fig. 4.

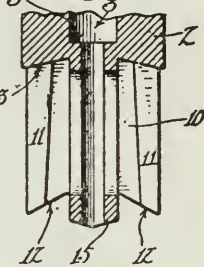


Fig. 5.

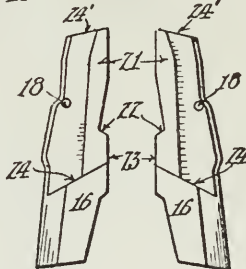
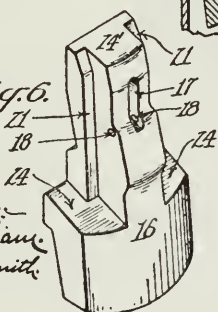


Fig. 6.



Witnesses:
Frank L. Graham,
Amos A. Smith.

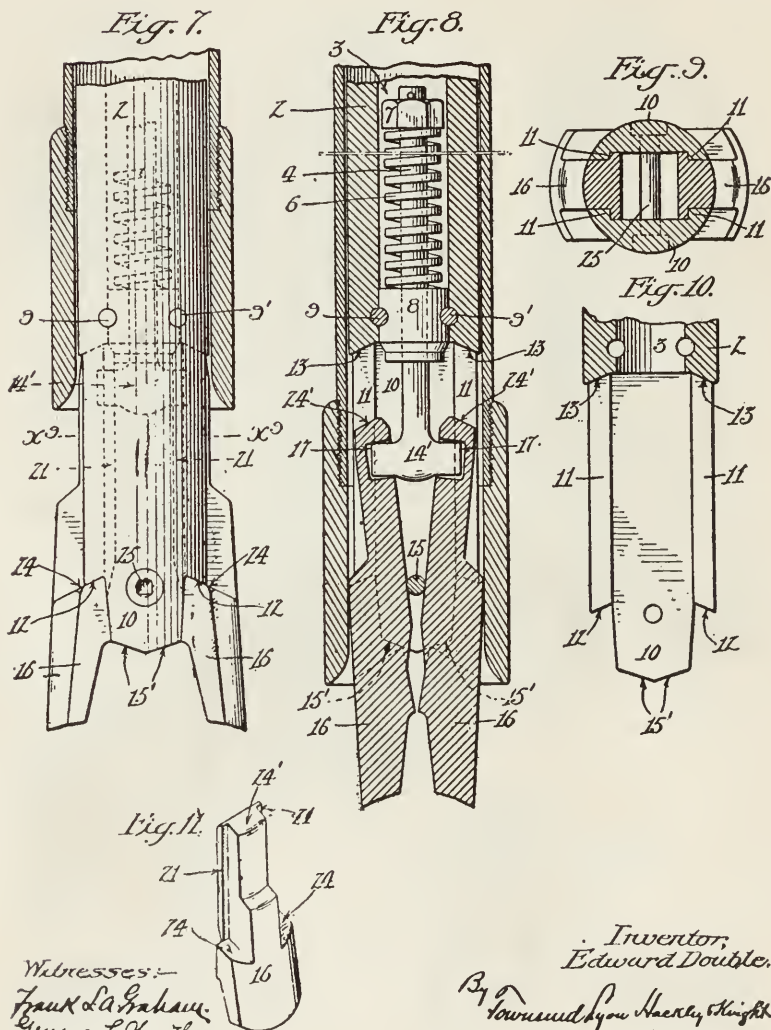
Inventor,
Edward Double.
By Townsend & Henry, Attys

No. 862,317.

PATENTED AUG. 6, 1907.

E. DOUBLE.
UNDERREAMER.
APPLICATION FILED SEPT. 10, 1906.

2 SHEETS—SHEET 2.



Witnesses:
Frank LaGrange,
General & Smith

Inventor,
Edward Double.
By J. Townsend & Son, New York, N.Y.
Attorneys

UNITED STATES PATENT OFFICE.

EDWARD DOUBLE, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER.

No. 862,317.

Specification of Letters Patent.

Patented Aug. 6, 1907.

Application filed September 10, 1906. Serial No. 334,046.

To all whom it may concern:

Be it known that I, EDWARD DOUBLE, a citizen of the United States of America, residing in the city of Los Angeles, in the county of Los Angeles, State of California, have invented certain Improvements in Underreamers, of which the following is a specification. This invention relates to underreamers for enlarging the bore of wells to permit the lowering of casing.

The object of this invention is to provide an underreamer which, when expanded to working position, shall possess the maximum strength, and in which the shock or impact shall be taken up by heavy solid portions of the body and bits or jaws and entirely removed from those portions of the reamer necessarily weakened to permit the jaws to expand and contract when the tool is lowered into and raised out of the well hole.

A further object of the invention is to render the expansion and contraction of the jaws certain and eliminate all possibility of the loss of the moving elements or parts in the well bore.

Preferably my improved underreamer comprises a body or mandrel having a central bore or chamber providing an open chamber within which longitudinally movable jaws or bits may tilt or swing to permit of their pivotal movement in expanding or contracting, and a hollow slotted extension or lower end, the two sides or wings of which are provided with shoulders forming dovetail ways, terminating at their upper or inner ends in inwardly inclined abutments on the mandrel proper, a spring actuated rod mounted in said bore or chamber, and jaws or bits pivotally mounted on said rod and provided with dovetail shoulders adapted to travel along said dovetail ways of the wings of the mandrel, and with portions adapted to contact with the lower end of the mandrel and thereby expand, the upper ends of the shanks of said bits or jaws having inwardly inclined surfaces corresponding to and adapted to bear upon said inwardly inclined abutments when the jaws are expanded, inwardly inclined shoulders being provided on the bits to bear against the corresponding inclined abutments formed at the extreme end of said slotted extension or lower end of the mandrel.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification and in which:—

Figure 1 is a side elevation of an underreamer embodying my invention, the same being shown with the bits or jaws projecting out of a well casing and in expanded position, the upper end of the mandrel being broken away. Fig. 2 is a longitudinal sectional view of an underreamer embodying my invention, the same being shown within a well casing. Fig. 3 is a sectional plan view on the line x^2-x^3 of Fig. 1. Fig. 4 is a longitudinal sectional view of the mandrel, the upper portion of which is broken away, the view showing particu-

larly the interior dovetail ways on the inner faces of one side or wing of the hollow extension or slotted end of the mandrel, and the inclined abutments at the inner or upper end of the dovetail ways and the inwardly inclined abutments at the extreme lower end of the mandrel. Fig. 5 shows side elevations of the jaws or bits. Fig. 6 is a perspective view of one of the jaws or bits. Fig. 7 is a side elevation of another embodiment of my invention, the same being shown with the bits or jaws in expanded position outside the well casing, the upper end of the mandrel being broken away. Fig. 8 is a longitudinal sectional view of the underreamer of Fig. 7. Fig. 9 is a sectional plan view taken on the line x^2-x^3 of Fig. 7. Fig. 10 is a longitudinal sectional view of the mandrel, the upper portion of which is broken away, the view showing particularly the interior dovetail ways on the inner faces of one side or wing of the hollow extension or slotted end of the mandrel, and the inclined abutments at the inner or upper ends of the dovetail ways and the inwardly inclined abutments at the lower end of the mandrel. Fig. 11 is a perspective view of one of the bits or jaws of Figs. 7—9.

In the drawings, 2 represents the mandrel proper which is provided with the usual screw threaded pin (not shown) at its upper end to screw into the socket of the "sub."

3 represents the central chamber or bore in which the spring actuated rod 4 is mounted. This bore terminates, preferably in a shoulder 5 (Figs. 2 and 3) against which the spring 6 coiled about the rod 4, bears the rod 4 operating through a reduced opening or bore. The upper end of the spring 6 bears against the head 7. (It is of course understood that the head 7 if desired may be in the form of a nut screwed onto the end of the rod 4). In Figs. 7 and 8 I have shown a block 8 which is removably held in the lower end of the bore 3 by dowel pins 9, 9', this block being provided with a central bore through which the rod 4 operates. Slightly below this shoulder 5, (Figs. 1, 2 and 4) or block 8, (Figs. 7, 8 and 10) I provide a hollow slotted extension of the mandrel proper, forming however an integral part and the lower end of the mandrel of the reamer. This extension has two similar sides or wings 10, provided on their inner faces with dovetail ways 11. These dovetail ways 11 are preferably inclined as shown in Figs. 1, and 4. These wings terminate in inwardly inclined shoulders or abutments 12 and similar inwardly inclined shoulders or abutments 13 are on the end of the mandrel proper at the upper ends of the dovetails 11 and between the wings or sides of the hollow extension.

In Figs. 1 and 2 I have shown the rod 4 as provided with a separate head or key 14, which in Figs. 7 and 8 the head or key 14' is shown integral with the rod 4. I prefer however to use the removable head or

key 14 and to provide an integral bar 15 bridging between the sides or wings 10 of the hollow extension, thus forming a shoulder preventing the loss of the rod 4 from the underreamer if the head 7 should break or if the nut (if used in place of the integral head) should unscrew and become detached. This also prevents the simultaneous loss of the bits in the well hole, as hereinafter set forth. The lower surface of the bar 15 may be double inclined, as shown, to enable me to utilize this surface as a means for causing the expansion of the bits or jaws. Where such bar 15 is not provided the extreme ends of the wings 10 are each double inclined for this purpose, as shown at 15' in Figs. 7 and 9.

The jaws or bits 16 are provided with sockets 17 somewhat larger than the head or key 14 to permit the pivotal movement or tilting of the bits or jaws. When a removable key 14 is used I prefer to provide the bits with holes 18 located just above the line of the lower edge of the head or key 14, when in place, and to insert pins 19 through these holes. As shown in Fig. 2 the removable head or key 14 is provided with an offset or wing 20 on its upper edge. This offset projects above the sockets or key seats 17 and prevents the accidental slipping of the head or key 14 from the rod 4 and bits 16. In order to remove the bits from the reamer it is necessary to first drive out the pins 19.

The upper ends of the shanks are inclined, as at 24', to correspond with the shoulders 13 and the sides of the shanks and provided with dovetail shoulders 21 to engage the dovetail ways 11 on the sides or wings 10 of the hollow slotted extension of the mandrel proper.

As shown in Figs. 1, 2, 3, 5 and 6, the bits 16 are provided with inclined expansion shoulders 22 and bearing faces 23, and as shown in Figs. 1—3, 5—9 and 11 with inclined shoulders 24 at the sides of the bits, the angle of inclination of these shoulders 24 corresponding with the inclination of the abutments 12 on the wings or sides 10 of the extension of the mandrel.

Preferably when the bar 15 is employed the same is extended up to the body portion of the mandrel proper, and is provided with a center bore in which the rod 4 operates, and also provided with a slot in which the head or key 14 works. Another advantage of this embodiment of my invention is that, as illustrated best in Fig. 3, when the bits are expanded the surfaces 23 bear upon the surfaces of the upward extension of the bar 15 and form substantially a solid bit or drill adapted to withstand the greater strains of underreaming.

With a construction, as shown in Figs. 7—10, wherein the bar 15 is not employed, the shoulders 24 are relied upon to cause the expansion of the bits as the same are drawn up by the spring 6 when the bits have passed out of the well casing, the shoulders 24 then riding up the inclined faces 15' of the ends of the wings 10 of the extension of the mandrel. In this form a detachable cross piece 25, in the form of a bolt, passes through the wings 10 near their lower ends. This cross piece 25 serves as a brace for the sides or wings of the extension of the mandrel. It also prevents accidental removal or loss of the jaws should the nut 7 become loose or the rod 4 break.

By thus providing the shoulders or abutments 12, 13 inclined or beveled inwardly and upwardly and the corresponding inclined shoulders or surfaces 24, 24' on the bits or jaws, the impact of the underreamer when at work causes the bits to be forced in towards the center of the mandrel and the strain to be taken at the points of greatest strength, avoiding all possibility of breaking the dovetails.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A bit or jaw, for an under reamer, having a body portion and a shank, the end of the shank beveled inwardly and upwardly, dovetail shoulders at the sides of the shank, inclined shoulders or abutments extending out laterally beyond the width of the shank and beveled to correspond with the bevel of the end of the shank, and an expansion surface on its inner face. 75
2. A bit or jaw, for an under reamer, having a body portion and a shank, the end of the shank beveled inwardly and upwardly, dovetail shoulders at the sides of the shank, inclined shoulders or abutments extending out laterally beyond the width of the shank and beveled to correspond with the bevel of the end of the shank, an expansion surface on its inner face, and a head or key seat opening at the inner surface of the shank. 80
3. A bit or jaw, for an under reamer, having a body portion provided with cutting edges and with an expansion surface or shoulder, and a shank provided with a head or key seat extending through the shank and with holes passing through the shank at the bottom of the key seat to receive key retaining pins. 85
4. A bit or jaw, for an under reamer, having a body portion provided with inwardly inclined abutments and expansion surface, and a shank having its upper end beveled, to correspond with the inclination of said abutments, said shank provided with a key or head receiving seat or socket. 90
5. An underreamer bit having two inwardly and upwardly inclined shoulders and a bearing-face on the inner side of each of said shoulders. 95
6. An under reamer bit or jaw having two inwardly and upwardly inclined shoulders and a bearing-face on the inner side of each of said shoulders, and also provided with a socket for the seating of a key or head. 100
7. An under reamer bit or jaw having two inwardly and upwardly inclined shoulders and a bearing-face on the inner side of each of said shoulders and also provided with a socket for seating a key and with pin-holes at the lower edge of said socket adapted to receive pins to prevent the accidental loss of the key or head from said socket. 105
8. In an under reamer, a mandrel furnished with a hollow slotted extension, and bits tiltingly and slidably connected with the mandrel and having their upper ends inwardly and upwardly inclined and also provided with shoulders or abutments inwardly and upwardly inclined, said extension having correspondingly inclined abutments between its wings or sides at its upper end and correspondingly inclined abutments at the lower ends of its wings or sides against which the upper ends and the inclined abutments of said bits bear when expanded. 110
9. In an under reamer, a mandrel furnished with a hollow slotted extension, and bits tiltingly and slidably connected with the mandrel and having their upper ends inwardly and upwardly inclined and also provided with shoulders or abutments inwardly and upwardly inclined and also provided with dovetail shoulders, said extension having correspondingly inclined abutments between its sides or wings at its upper end against which the upper ends of the bits are adapted to bear when expanded and correspondingly inclined abutments at the lower ends of its sides or wings against which the inclined abutments of the bits bear when expanded, said mandrel extension provided with dovetail ways on the inner faces of its sides or wings coacting with the dovetail shoulders of the bits. 115
10. An under reamer mandrel having a central bore and a hollow slotted extension at its bottom, the wings or sides of said extension having dovetail ways on their inner faces and upwardly and inwardly inclined abut- 120

862,317

8

ments at their lower ends, inwardly and upwardly inclined abutments being formed between the sides or wings of the extension at the upper end thereof.

5 11. An under reamer mandrel having a central bore and a hollow slotted extension at its bottom, the wings or sides of the extension having inwardly and upwardly inclined abutments at their lower ends, inwardly and upwardly inclined abutments being formed at the upper end of said extension between the sides thereof.

10 12. An under reamer comprising a mandrel having a central bore and a lower extension consisting of two wings or sides having dovetail ways on their inner faces and having inwardly and upwardly inclined abutments at their ends, a spring actuated rod slidably mounted in the central bore of said mandrel and a head or key therefor, 15 bits or jaws provided with seats or sockets for said key or head permitting said jaws to tilt on said key or head, said bits or jaws provided with dovetail shoulders and with inwardly and upwardly inclined abutments corresponding to and coacting with the dovetail ways and inclined abutments of said mandrel.

25 13. An under reamer comprising a mandrel having a central bore and a lower extension consisting of two wings or sides having dovetail ways on their inner faces and inwardly and upwardly inclined abutments at their ends, a spring-actuated rod slidably mounted in said central

bore, a removable key or head therefor, bits or jaws provided with key-seats or sockets somewhat larger than said key permitting the jaws to tilt on said key, retaining pins 30 passing through the jaws and through the lower portions of the key-seats and preventing the accidental slipping of the key from said rod and seats, said bits or jaws provided with dovetail shoulders and with inwardly and upwardly inclined abutments corresponding to and adapted to coact with the dovetail ways and inclined abutments of 35 said mandrel.

14. An under reamer comprising a mandrel, bits slidably mounted on opposite sides of a portion of said mandrel and furnished on their inner faces with key-seats, 40 said key seats being somewhat larger than the key on the operating rod, a spring-actuated operating rod playing lengthwise of the mandrel and furnished with a key-seat, and a key having a wing or flange at its center mounted in said key-seat on said rod, said bits having retaining pins passing through their key-seats and preventing the 45 accidental removal of said key from said rod or bits.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 4th day of September 1906.

EDWARD DOUBLE

In presence of—

FREDERICK S. LYON,
FRANK L. A. GRAHAM.

**Complainants' Exhibit Wilson File Wrapper and
Contents.**

2—390.

UNITED STATES OF AMERICA,
DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

To all to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true
copy from the Records of this Office of the File
Wrapper and Contents in the matter of the

Letters Patent of

Elihu C. Wilson,

Number 827,595,

Granted July 31, 1906,

for

Improvement in Underreamers.

IN TESTIMONY WHEREOF I have hereunto set
my hand and caused the seal of the Patent Office
to be affixed at the City of Washington, this 11th day
of November, in the year of our Lord one thousand
nine hundred and twelve and of the Independence of
the United States of America the one hundred and
thirty-seventh.

[Seal]

C. C. BILLINGS,

Acting Commissioner of Patents.

[Endorsed]: U. S. Dist. Ct., So. Dist. Cal., So.
Div. 1540—Equity. Union Tool Co., v. Wilson
& Willard. "Complainants' Exhibit File Wrapper
Contents." Leo. Longley, Special Examiner.
Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By
Chas N. Williams, Deputy Clerk.

2-437.

Div.

NUMBER (SERIES OF 1900).

1905

DIV. 38

289,380

(EX'R'S BOOK). 219-1

PATENT No. 827,595

Name—Elihu C. Wilson

of Bakersfield

County of

State of California

Invention—Underreamer

Division of App., No. , filed
PARTS OF APPLICATION FILED.

ORIGINAL.	RENEWED.	
Petition	Nov. 28, 1905	, 190
Affidavit	“ “ 1905	, 190
Specification	“ “ 1905	, 190
Drawing 2 shts.	“ “ 1905	, 190
Model or Specimen		, 190
First Fee Cash \$15.00	Nov. 28, 1905	, 190
“ “ Cert.		, 190
Appl. filed complete	Nov. 28, 1905	, 190

Examined—A. P. Shaw Ex. July 10, 1906 , 190

Countersigned—W. W. Mortimer , 190

7-12-1906 For Commissioner. For Commissioner.

Notice of Allowance—July 12, , 1906 , 190

Cert.

Final Fee Cash Dated June 13 , 1906 , 190

“ “ Cert. \$20. June 18 , 1906 , 190

Patented July 31 , 1906

2 Associate Attorney

Attorney—James R. Townsend,

430 Bradbury Bldg.

Los Angeles, Cal.

Name Serial Number

Patent No. Date of Patent

36 *Wilson & Willard Manufacturing Company*

James R. Townsend,
Townsend Bros., Patent Attorneys,
430-433 Bradbury Building,
Los Angeles, Cal.

\$15 RECEIVED.

Ck.

NOV. 28, 1905.

S.

CHIEF CLERK U. S. PATENT OFFICE.

289, 380 Paper No. 1½

MAILED

NOV. 22, 1905.

James R. Townsend.

Elihu C. Wilson.

Underreamer.

Los Angeles, Cal.

HON. COMMISSIONER OF PATENTS:

Sir: We herewith hand you Petition and Power of Attorney, Specification, Oath and two sheets of Drawings, in the matter of the above-entitled application for U. S. Patent.

Also enclosed find our check for \$15.00, in payment of filing fee thereon.

Kindly file, acknowledge receipt, and oblige,

Yours respectfully,

JAMES R. TOWNSEND.

Adam.

MAIL ROOM.

NOV. 28, 1905.

U. S. PATENT OFFICE.

Townsend Bros.

REGISTERED ATTORNEYS

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend, Francis M. Townsend
430-433 BRADBURY BLOCK, Los Angeles,
California.

PETITION AND POWER OF ATTORNEY,
TO THE HON. COMMISSIONER OF PATENTS.

Your petitioner Elihu C. Wilson whose Post Office address is Bakersfield, Kern County, California, a citizen of the United States residing at Bakersfield in the county of Kern and State of California, prays that letters patent may be granted to him for the ~~improvement in~~ Underreamer set forth in the annexed specification, and he hereby appoints ~~the~~ firm of TOWNSEND BROS., the individual members of which firm are James R. Townsend and Francis M. Townsend of Los Angeles, California his attorney with full power of substitution and revocation to prosecute this application to make alterations and amendments therein, to receive the patent and to transact all business in the PATENT OFFICE connected therewith.

ELIHU C. WILSON.

SPECIFICATION:

To All Whom it May Concern:

Be it known that I, Elihu C. Wilson, a citizen of the United States, residing at Bakersfield, in the County of Kern, and State of California, have invented a new and useful UNDERREAMER, of which the following is a specification.

Objects of this invention are to provide an under-reamer of superior strength and of superior width and expansion of cutters so as to enable reaming as great a portion of the circumference of the hole as possible at each stroke; to ensure greater safety against losing the cutters from the body while reaming; to avoid the necessity of a middle joint in the

Insert E¹ mandrel or reamer body. ^Λ
E¹

By this invention it is possible to increase the strength of the cross or tee which suspends the cutters. In this invention a cross or tee formed of a single forging is provided for suspending the cutters.

Another decided advantage is simplicity and convenience of attaching and removing the cutters and suspending devices from the reamer body.

Another advantage is facility of collapsing the cutters. I so construct the mouth of the under-reamer as to dispense with stock between the collapsed cutters, thus enabling the cutters to close together. This feature makes extreme expansion possible, and makes the use of maximum amount of stock in shanks of cutters possible, thus insuring maximum strength of cutters.

The accompanying drawings illustrate the invention:

Figure 1 is a view of the underreamer in a casing just before it has passed through the shoe of the casing, the parts being collapsed.

Fig. 2 is a view looking at the bottom of Fig. 1.

Fig. 3 is a view of this newly-invented underreamer in a well, the same having just passed through the casing shoe, and expanded for reaming the hole below; portions shown in mid-section.

Fig. 4 is a view looking at the bottom of Fig. 3.

Fig. 5 is a view of the reamer body at right angles to Figs. 1 and 2.

Fig. 6 is a view looking at the bottom of Fig. 5.

Fig. 7 is a front view of a cutter detached.

Fig. 8 is an edge view of a cutter at right angles to Fig 7.

Fig. 9 is a view of the inside or back of the cutter.

Fig. 10 is a view looking down on the top of the cutter.

Fig. 11 is a view of the cross.

Fig. 12 is a view of the cross at right angles to Fig. 11.

Fig. 13 is a side view of the spring seat block detached.

Fig. 14 is a bottom view of the same.

1 designates a hollow body of an underreamer terminating in Λ forks 2 which terminate in down-
Insert B₁ to spread the cutters apart

per B wardly projecting lugs, 2' Λ 3 designates ways
formed by the forks. 4 designates the cutters which
are

Λ interchangeable; 4¹, the cutter shank; 4², bearing shoulders of the cutters to engage inside the ways

40 *Wilson & Willard Manufacturing Company*

per B on the sides of said cutters
 Insert 3; 4³, expansion bearing faces of the cutters, Λ
 D¹ 5 is a cross; 5' the stem of the cross, and 6 the
 spring which actuates the cross. The parts 5, 5',
 constitute spring-actuated means for actuating the
 cutters to expand the same.

7 is a block forming a seat for the spring 6. One
 or more dowel pins 8 may be provided as means for
 holding the block or spring seat 7 in place. 9 desig-
 Insert for holding the cutters 4 apart
 D² nates the spreading-bearings Λ , and 10 the down-
 thrust bearings for the cutters. 11 is a detachable
 cross-piece in the form of a bolt secured by a nut 12.
 13 is an angular socket in the outer face of one of the
 forks around the bolt-hole 14 in said fork. The nut
 12 is conformed to the angular socket, and the bolt 11
 is provided with an angular socket 15 in its head
 to receive a wrench, not shown, for screwing the
 bolt into the nut.

The expansion bearing faces 4³ terminate at their
 per B or bearings
 upper ends in rounded corners Λ 16 to ride more
 readily over the beveled end faces 17 of the down-
 per B to engage said bearings
 wardly-projecting lugs 2' Λ , for expanding the cut-
 ters. 18 designates recesses in the inner faces of the
 cutters for engaging the ends of the cross 5.

19 and 20 indicate the usual tension nut for the
 spring 6 and the cotter-pin for securing the same.

To assemble the underreamer, the block 7
 will first be placed on the stem 5' of the cross
 5, and the spring 6 is then adjusted and se-
 cured in place by the nut 19 and cotter-pin 20.
 Then the cutters are placed on the ends re-

spectively of the cross 5 which seat in the recesses 18 therefor. Then the parts thus assembled are inserted into the hollow mandrel and brought into the position shown in Fig. 3, whereupon the dowel pins 8 are inserted and the cross-piece formed of the bolt 11 is then inserted; the nut 12 is placed in its angular socket 13, and the bolt or cross-piece 11 is then screwed home. The underreamer is then in condition for operation.

To use the underreamer, the cutters will be drawn down below the downwardly-projecting lugs 2', thus collapsing the same into the position shown in Fig. 1, whereupon the underreamer will be inserted into the pipe or casing in the usual manner and allowed to descend. When it has passed through the shoe, as shown in Fig. 3, the spring operates in the usual manner to draw the cross 5 up, thus bringing the cutters into the expanded position shown in Fig 3. The rounded shoulders 16 ride readily over the beveled faces 17, and the upper ends of the cutter stems seat against the down-thrust bearings 10, and the bearing shoulders 4² of the cutters engage the ways 3 of the fork prongs or members 2, thereby being solidly held during the operation of underreaming. The spreading bearings 9 of the lugs 2' engage the expansion bearing faces 4³ of the cutters at the same time so that the tool is practically a unit during the operation of underreaming.

30 designates the usual shoulders on the cutters for drawing the same in when the tool is removed through the pipe or casing 40.

It is advisable that the lower ends of the forks 2

should not form down-thrust bearings for the cutters as there would otherwise be a tendency of crystallization of said forks, which is avoided by making the down-thrust bearings at 10 only.

The cross-piece 11 serves as a brace for the prongs of the fork, and prevents accidental removal of the cutters and tee or cross 5.

Insert
D³

What I claim is:—

per B 1. An underreamer ^{body} Λ having projecting lugs at its mouth for expanding the cutters.

per B 2. An underreamer ^{body} Λ provided with upper and lower bearings for its expanded cutters, the lower bearing being formed of lugs projecting at the mouth of the reamer.

Sub D⁴ 3. An underreamer ^{body} Λ having cutter bearings for the down-thrust and bearings for expanding the cutters, the latter being formed of projecting lugs at the mouth of the reamer.

4. An underreamer ~~having a~~ body terminating prongs forming said prongs having shoulders on their inner faces in Λ a fork Λ to form ways for the cutters.

Sub D⁴ 5. A hollow underreamer body terminating in prongs forming having shoulders on the inner faces to form Λ a fork ~~forming~~ Λ ways for the cutters, cutters in said ways, a cross in said hollow body for operating said cutters, a spring for operating the cross, a block in the body to form a seat for said spring, and one or more dowel pins securing the block in place.

6. A hollow underreamer body, cutters, a cross inside the hollow body for operating said cutters, a

spring for operating said cross, a block in said body forming a seat for said spring, and one or more dowel pins for holding the block in place Λ

Insert B2

B2

7. A hollow underreamer body provided with cutter ways and bearings, cutters in said ways and engaging said bearings, spring-actuated means for actuating said cutters, and a block secured in said hollow body and extending below said bearings to hold the upper ends of the said cutters apart.

per B

terminating in prongs forming a fork and

7. 8. A hollow underreamer body Λ provided with ways and down-thrust bearings for cutters, cutters in said ways engaging said bearings, a cross for operating said cutters, a spring for actuating said cross, a block forming a guide for the stem of the cross and a seat for the cross-actuating spring, Λ projecting

and

B3

below the down-thrust bearings to hold the upper ends of the cutters apart, and means for holding the block in the reamer body.

Insert B3

8 9. A hollow underreamer body terminating in Λ a fork, cutters held by Λ said fork, Λ means for

prongs forming in ways

er B

er B

Insert

4

B4

operating the cutters, and a detachable cross-piece connecting the ends of the fork.

9 10. An underreamer body terminating in Λ a fork Λ which forms cutter ways and terminates in

prongs forming

B5

downwardly-projecting lugs, and cutters mounted between the prongs of said fork and having should-

er B

Insert B5

er D

er B

44 *Wilson & Willard Manufacturing Company*

ers inside the fork and faces to bear on the projecting lugs.

per D
sub E2

10 ~~11~~. An underreamer having lugs at the sides of the
A lower end of its body to hold the cutters apart.

12. An underreamer body terminating in a fork and a cross-piece forming a brace for the prongs of the fork.

13. An underreamer body terminating in a fork, cutters and means for suspending the same in said body, and a cross-piece extending between the prongs below the suspending means.

per
B

14. An underreamer body having down-thrust bearings and forks below said bearings, cutters held by said forks and provided with shoulders to engage the down-thrust bearings, and means for holding the cutters expanded in position with their shoulders in engagement with said down-thrust bearings.

per B

11 ~~15~~. An underreamer body terminating in A a fork having beveled faces at the ends of its prongs, cutters having shoulders to ride over said beveled faces, and means for suspending said cutters in said body.

Insert A1

— IN TESTIMONY WHEREOF, I have hereunto
Bakersfield
set my hand at Los Angeles, California, this 20th day
of November, 1905.

ELIHU C. WILSON.

In presence of:

H. I. TUPMAN.

T. E. KLOPSTEIN.

OATH.

STATE OF CALIFORNIA,

KERN

COUNTY OF ~~LOS ANGELES~~,—ss.

Elihu C. Wilson, the above-named petitioner, being duly sworn, deposes and says that he verily believes himself to be the original, first and sole inventor or discoverer of the ~~improvement in~~ Underreamer described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof; or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application; or in public use or on sale in the United States for more than two years prior to this application, and that no application, for patent on said improvement has been filed by him or his legal representatives or assigns, in any foreign country, ~~except~~ as follows:

And said ——— states that he is a citizen of the United States, and resident of ——— in the County of Los Angeles, and State of California.

And said Elihu C. Wilson states that he is a citizen of the United States and resident of Bakersfield in the County of Kern and State of California.

ELIHU C. WILSON.

Subscribed and sworn to before me this 20th day of November, 1905.

[Seal]

H. I. TUPMAN,

Notary Public, in and for the County of Kern, State of California.

MAIL ROOM.

DEC. 26, 1905.

U. S. PATENT OFFICE.

U. S. Patent Office,

DEC. 27, 1905.

DIVISION 38.

289380 Paper No. 1.

Amdt. A.

IN THE UNITED STATES PATENT OFFICE.

Division 38,

Room No.

Paper No. 1.

MAILED

Elihu C. Wilson,

Underreamer,

Filed Nov. 28, 1905.

Ser. No. 289,380.

TO PATENT OFFICE

DEC. 19, 1905.

James R. Townsend.

Los Angeles, Cal., Dec. 19, 1905.

Hon. Commissioner of Patents,

Sir:—Upon further consultation with the applicant before receiving action from your Office, please add the following claim in the above mentioned application for patent; namely:—

18 ~~16~~. An underreamer having a body terminating in a fork, and cutters suspended between the prongs of the fork, the ends of said prongs being constructed and arranged to wedge between adapted to spread Δ the cutters apart. —

Very respectfully,

JAMES R. TOWNSEND,

Atty. for Wilson.

Approved:

E. C. WILSON.

sub D^s

A¹

per C

per C

Insert
B^s

L. C.

Paper No. 1.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. 38, Room 378.

Address only

“The Commissioner of Patents, Washington, D. C.”

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE

WASHINGTON, D. C., January 9, 1906.

MAILED “ “ “

Elihu C. Wilson,

Care James R. Townsend,

#430 Bradbury Bldg.,

Los Angeles, Cal.

Please find below a communication from the Examiner in charge of your application. for “Under-reamer,” filed November 25, 1905, Serial No. 289,380.

F. I. ALLEN,

Commissioner of Patents.

The shape of the ways 3 should be illustrated showing how the guides 42 operate.

Claim 1 is rejected on—

Swan, 683,352, Sept. 24, 1901, Artesian & Oil Wells,
Reamers.

Claims 2 to 6, inclusive, are rejected on—

Double, 748,054, Dec. 23, 1903, (Same Class).

There is considered to be no invention in substituting dowel-pins for screw-threads to hold in the block, as they are both within the knowledge of an

48 *Wilson & Willard Manufacturing Company*

ordinary mechanic.

Claims 7 to 14, inclusive, are rejected on—

Double, 796,197, Aug. 1, 1905, (Same Class).

Claim 16 is objected to as it differs from the patents to Double, cited, only in statements of function.

Claim 15 is allowed.

A. P. SHAW, Ex.

MEP.

U. S. Patent Office.

MAIL ROOM

289,380. Paper No 4.

MAR. 14, 1906.

DIVISION 38.

MAR. 12, 1906.

Amdt. B.

U. S. PATENT OFFICE.

MAILED

TO PATENT OFFICE

MAR. 6, 1906.

Elihu C. Wilson,

Div. 38

Underreamer,

Room 378.

Filed Nov. 25, 1905,

Paper #2.

Ser. No. 289,380.

James R. Townsend.

Los Angeles, Cal., March 5, 1906.

Hon. Commissioner of Patents,

Sir:—Office letter of January 9, 1906, and the patents referred to have been considered.

Page 2, last line, cancel “forks 2 which” and sub-

stitute—prongs 2 forming a fork; said prongs having shoulders 2” on their inner faces to form ways 3 for cutters. Said prongs are provided with and—

Before the period insert—to spread the cutters

apart.— The clause as amended will read as follows:—1 designates a hollow body of an underreamer

terminating in prongs 2 forming a fork; said prongs having shoulders 2" on their inner faces to form ways 3 for cutters. Said prongs are provided with and terminate in downwardly-projecting lugs 2' to spread the cutters apart.—

Page 3, line 1, cancel "3 designates ways formed by the forks." Line 4, change the period to a comma and add—on the sides of said cutters.— Line 20, after "corners" insert—or bearings—; line 21, before "for" insert—to engage said bearings—.

Claims 1 and 2, line 1, after "underreamer" insert—body—. It is requested that claims 1 and 2 be reconsidered and allowed for the reason that the patents do not show any lugs at the mouth of the underreamer body for expanding the cutters. The term "lugs" can only be applied to projecting parts, and no parts are shown in the patents which come within the definition of the term "lugs."

Claim 3, line 1, after "underreamer" insert—body—; line 3, before "projecting" insert—downwardly—; after "reamer" insert—body—.

Reconsideration and allowance of this claim is requested in view of the foregoing.

Claim 4, line 1, cancel "having a"; after "in" insert—prongs forming—; line 2, after "fork" insert—, said prongs having shoulders on their inner

faces—. The claim as amended reads:

—4. An underreamer body terminating in prongs forming a fork, said prongs having shoulders on their inner faces to form ways for the cutters.

Claim 5, line 1, after “in” insert—prongs forming—; line 2, for “forming” substitute—having shoulders on the inner faces to form—.

Claim 6, before the period insert—, said block and pins being located entirely above the head of the cross.—

Cancel claim 7.

Claim 8 renumber as 7. Line 1, after “body” insert—terminating in prongs forming a fork and—; line 6, after “spring” insert—its lower end terminating above the head of the cross—.

Claim 9 renumber as 8. Line 1, after “in” insert—prongs forming—; before line 2 insert—said prongs having shoulders on their inner faces to form ways,—; line 2, substitute—in—for “held by”; substitute—ways—for “fork.” The claim as amended reads:

—8. A hollow underreamer body terminating in prongs forming a fork, said prongs having shoulders on their inner faces to form ways, cutters in said ways, means for operating the cutters, and a detach-

able cross-piece connecting the ends of the fork.—

Claim 10 renumber as 9. Line 1, after “in” insert—prongs forming—; after “fork” insert—and provided with shoulders on the inner faces of the prongs—; line 2, change “forms” to—form—.

Claim 11 renumber as 10. Reconsideration and allowance of this claim is requested in view of the fact that none of the patents show the lugs called for in this claim, it being understood that the term “lugs” is limited to projecting devices, none of which for this purpose is shown in the patents.

Cancel claims ~~11~~, 12, 13, 14.

Claim 15 renumber as 11. Line 1, after “in” insert—prongs forming—.

Add the following claims:

—12. An underreamer body terminating in prongs forming a fork, the ends of said prongs being provided with lugs to spread the cutters apart.

13. An underreamer body terminating in prongs forming a fork, said prongs having shoulders on the inner faces to form ways for the cutters, and said prongs terminating in lugs to act as spreaders for the cutters.

14. A hollow underreamer body terminating in prongs forming a fork, said prongs terminating in lugs for spreading the cutters, said lugs having beveled ends to engage bearings on cutters to expand cutters.

15. An underreamer body terminating in prongs

forming a fork, said prongs terminating in lugs or projections, said lugs having beveled faces or bearings to expand the cutters, and also faces or bearings for the cutters to rest on after they have expanded to a normal position for reaming.

16. ~~An underreamer cutter having shoulders or projections on its sides to form bearings to rest on the lugs of the underreamer body.~~

17. ~~An underreamer cutter having shoulders to bear on the lugs of the underreamer body, and having shoulders or projections on its sides to bear against the shoulders on the inner faces of prongs of underreamer body when cutters are expanded to normal position for reaming.—~~

It is believed that the foregoing is in accordance with the views of the Examiner as expressed in a private interview with the inventor, and the application will now be found in condition for issue.

Favorable consideration is therefore requested.

Very respectfully,

JAMES R. TOWNSEND,

Attorney for Wilson.

L. C.

Paper No. 4.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. 38, Room 378.

Address only "The Commissioner of Patents, Washington, D. C."

DEPARTMENT OF THE INTERIOR.

UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., March 21, 1906.

MAILED " " "

Elihu C. Wilson,

Care J. R. Townsend,

Bradbury Building,

Los Angeles, Cal.

Please find below a communication from the Examiner in charge of your application, for "Underreamer," filed November 28, 1905, Serial No. 289,380.

F. I. ALLEN,

Commissioner of Patents.

In response to the communication filed March 12, 1906:

Claims 1 to 4, inclusive, are rejected on Double, 748,054, of record, which shows shoulders on the inner faces for guiding the cutters.

Claim 5 is rejected on Double, 748,054, in view of Double, 796,197, of record. The use of dowel pins for the bolt of Double or the screw-threads shown in—

Swan, 717,469, Dec. 30, 1902, (Same Class); is not considered patentable.

54 *Wilson & Willard Manufacturing Company*

Claim 8 is rejected on Double, 748,054 in view of Double, 796,197, of record, showing a cross-piece at the end of the forks.

Claim 9 is objected to as it is not clear to what "which" in line 2 refers. If "forms" is changed "terminates" should also be changed.

Claim 10 is rejected on Double, 748,054, of record, as not distinguishing therefrom.

Claims 16 and 17 are rejected on Double, 748,054, of record. Furthermore, the article of Manufacture cannot be limited by the device with which it is used.

Original claim 16 has not been amended and the objection made in the last Office letter is repeated.

Attention is called to the fact that claims 11, 12, 13, and 14, are directed to be canceled. In view of other portions of the amendment only original claims 12, 13, and 14, have been canceled.

Claims 6, 7, 11, 12, 13, 14 and 15, are allowed.

M.E.P.

A. P. SHAW Ex.

289,380 Paper No. 5.

Amdt. C.

U. S. Patent Office.

MAIL ROOM. MAR. 28, 1906.

MAR. 27, 1906. DIVISION 38.

U. S. PATENT OFFICE.

MAILED

TO PATENT OFFICE

MAR. 21, 1906.

James R. Townsend.

Div 38.

Room 378.

Paper #3.

IN THE UNITED STATES PATENT OFFICE.

Elihu C. Wilson,
Underreamer,
Filed Nov. 25, 1905,
Serial No. 289,380.

Los Angeles, Cal., March 12, 1906.

Hon. Commissioner of Patents,

Sir: It is noted in my amendment dated at Los Angeles, March 5, 1906, page 3, line 9 should read:
—Cancel claims 12, 13 and 14—, therefore please
correct said line to read accordingly.

Claim 16 was overlooked in said amendment there-
fore renumber said claim 16 to be 18.

I amend said claim as follows: Line 3 of the claim
change “adapted to spread” to—constructed and
arranged to wedge between—. Last line, cancel
“apart.” This claim now clearly sets forth the ar-
rangement of the prongs with relation to the cutters
and no reason is seen why it may not be allowed.

Respectfully submitted,

JAMES R. TOWNSEND,
Attorney for Wilson.

AHM-M-
A. H. MERRILL.

L. C.

Paper No. 6.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. 38, Room 378.

Address only

"The Commissioner of Patents,
Washington, D. C."

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., April 3, 1906.

MAILED " " "

Elihu C. Wilson,
Care J. R. Townsend,
Bradbury Bldg.,
Los Angeles, Cal.

Please find below a communication from the EX-AMINER in charge of your application.
for "Underreamer", filed November 28, 1905, Serial
No. 289,380.

F. I. ALLEN,
Commissioner of Patents.

In response to the communication filed March 27,
1906:

Claims 12, 13, and 14, were canceled in view of the amendment of March 12, 1906.

Claim 18 as amended is objected to as being indefinite on account of the phrase "constructed and arranged." Such a phrase does not define any structure.

M.E.P.

A. P. SHAW, Ex.

U. S. Patent Office.

MAIL ROOM 289,380, Paper No. 7.

APR. 17, 1906.

APR. 16, 1906.

Amdt. D.

DIVISION 38.

U. S. PATENT OFFICE.

MAILED

TO PATENT OFFICE

APR. 10, 1906.

James R. Townsend.

Div. 38

Room 378

Paper No. 6.

IN THE UNITED STATES PATENT OFFICE.

Elihu C. Wilson,

Underreamer,

Filed Nov. 28, 1905,

Ser. No. 289,380.

Los Angeles, Cal., April 9, 1906.

Hon. Commissioner of Patents,

Sir: Office letter of March 21, 1906, and the patents referred to have been considered. Amend the specification as follows:—

Page 3, after line 4 insert:

The inner faces of the prongs 2 are parallel, and the sides or shoulders 2" which form the ways 3 are also parallel; the cutter-shank 4' and its bearing

4²

shoulder \wedge 4" are straight; that is to say, the sides or edges thereof are parallel and fit the ways 3.—

After line 12, Page 3, insert:

D^a The down-thrust bearings 10' are in the nature of shoulders formed by the edges of the forks at the base of the lugs 2'. The prongs 2 of the body are of substantially one thickness throughout, excepting that they are reduced at their lower ends to form lugs for spreading the cutters 4 apart. The edges of the lugs 2' form the spreading bearings 9, and the prongs terminate abruptly in the shoulders 10' at the base of the lugs 2". This construction affords the necessary operative structure with maximum strength for minimum weight of body.

At the end of page 5 add:

D^a It is to be noted that by the construction shown the cutters are quickly expanded at the initial upward movement of the same after escaping the shoe of the casing 40; and that immediately thereafter the cutters are solidly held in the straight and parallel ways 3, and that when the cutters are fully drawn up they seat on the down-thrust bearings 10 and the spreading bearings 9, while the shanks are rigidly held throughout their length. Said spreading bearings are on the lugs 2' which constitute wedges for wedging the cutters apart, and said bearings are at the sides of the lower ends of the body, thus engaging the outer edges of the cutters to hold the cutters apart, and leaving an open space between the middle portions of the cutters for a greater distance upward from the lower ends of the cutters than would be the case were the cutters held apart by any intermediate portion between the lugs.

I term the cutters "shouldered cutters" for the reason that the rounded corners 16 which extend away from the shank at right angles thereto are in the nature of shoulders, the inner faces 4³, of which engage the spreading faces 9 of the side lugs 2' to brace the cutters and hold them apart.

Rewrite claims 1, 2 and 3 to read as follows:—

1. An underreamer body terminating in prongs having projecting *lugs* at their lower ends with spreading bearings 9 for holding the cutters apart.

2. An underreamer body terminating in prongs and provided with upper and lower bearings for ^{the} ~~its~~ ~~expanded~~ ~~Λ~~ cutters, said prongs having projecting *lugs*, the edges of which form lower bearings for holding the cutters apart, and the ends of said lugs having beveled end faces.

3. An underreamer body terminating in prongs the inner faces of which are provided with straight parallel ways, ~~the cutters having straight shanks fitting said ways~~, the ends of said prongs terminating in *lugs* below said ways to spread and hold the cutters apart.

I request reconsideration and allowance of claim 4 for the reason that Double 748,054 does not show a cutter body terminating in prongs forming a fork. Upon the contrary, the Double body is provided with a web 6 on each side of which are recesses 4 and 5, there being a slot 7 through the *web*. The Double underreamer body in #748,054 clearly does not anticipate claim 4 which is limited to the body termi-

nating in prongs forming a fork.

It is thought that the rejection of claim 4 on this reference was an inadvertency, as the applicant advises the writer as follows:

“You can remind the Examiner, that he and I investigated that particular point very carefully, while I was in Washington, and we discovered that no patent had ever been issued, covering on forked mouth reamers with shoulders on their inner faces. He stated without hesitation, that I was entitled to that claim. The Double patent certainly does not cover on the reamer terminating in prongs forming a fork. He apparently quite overlooks the difference in the construction of the two reamers. I will ask you to again request an allowance of that claim.”

In view of the foregoing I request reconsideration and allowance of claim 5. The downwardly-extending *lugs*, 3, 3' in the Double patent #796,197 do not suggest the prongs *having shoulders* on the inner faces to form ways for the cutters, and since Double #748,054 does not suggest any forked structure, and Double does not in fact in either patent show the structure claimed in the first two lines of claim 5; nor are the dowel pins or the rest of the claimed combination found in any of the patents in the relation stated, it is thought this claim, upon reconsideration, will be allowed.

Please reconsider and allow claim 8 in view of the foregoing. Double #748,054, as above stated, does not show a fork, and Double #796,197, issued long after, does not show any shoulders on the inner

faces to form the ways. It is believed that the Examiner will see his way to allow this claim.

Claim 9, line 2, change "terminates" to—terminate—.

Claim 10, line 1, before "lower" insert—sides of the—.

Cancel claims 16 and 17 and substitute therefor:

16. An underreamer cutter having two shoulders and a bearing face on the inner side of each of the two shoulders of the cutter.

17. An underreamer cutter having a shank and a shoulder on either side of the shank of the cutter, each of said shoulders projecting at right angles to the shank of the cutter and having a bearing face on its inner side.

Rewrite claim 18 to read as follows:—

18. An underreamer having a body terminating in a fork, and cutters suspended between the prongs of the fork, the ends of said prongs constituting wedges to wedge between the cutters.

It is believed that the foregoing avoids all objection and places the case in condition for issue.

The final fee is herewith transmitted and it is requested that the patent issue as early as possible.

Very respectfully,

JAMES R. TOWNSEND,

JRT—J.

Attorney for Wilson.

MAILED
TO PATENT OFFICE

APR. 10, 1906.

ACCOUNT 289,380, Paper No. 8.
MAIL ROOM Amdt. (drg.)
APR. 16, 1906, James R. Townsend.
U. S. PATENT OFFICE.

IN THE UNITED STATES PATENT OFFICE.

E. C. Wilson, Div. 38
Underreamer, Room 378
Filed Nov. 28, 1905, Paper #5.
Ser. No. 289,380.

Los Angeles, Cal., April 9, 1906.

Hon. Commissioner of Patents,

Sir: The application has been considered in view
of Office letter dated March 21, 1906.

Additional reference characters appear to be re-
quired on the drawing. Please add to the drawing
the character 2".

In Figure 5 apply said character immediately be-
low the character 3 and connect it with the solid
lines at the left and right.

In Fig. 6 apply the character 2" inside the circle
and connect the same by leaders with the lower faces
of the two triangles which are above said circle and
the upper faces of the two triangles which are below
said circle.

In Figs. 1, 5, and 6, apply the characters 10', and
connect the same by leaders with the shoulders at
the base or upper end of the lugs 2"; said shoulders
being represented by the four triangles in Fig. 6, by

the two shoulders in Fig. 1, and by the two shoulders in Fig. 5.

If any expense attaches charge my account for the same.

Very respectfully,

JAMES R. TOWNSEND,

JRT—J.

Atty. for Wilson.

Townsend J. R. C. U. S. Patent Office. Number 81548. Received Apr. 16, 1906. Chief Clerk. Apr. 16, 1906. Corrected and forwarded 4/30/06. No. Chg. Forward to mail room for Div. 38. Mail Room, May 1, 1906. Transfer to Div. 38. U. S. Patent Office. May 1, 1906. Division 38.

L. C.

Paper No. 9.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. 38, Room 378.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., May 4, 1906.

MAILED “ “ “

Elihu C. Wilson,

Care James R. Townsend,

Bradbury Bldg.,

Los Angeles, Cal.

Please find below a communication from the EX-

AMINER in charge of your application, for "Underreamer," filed November 28, 1905, Serial No. 289,380.

F. I. ALLEN,
Commissioner of Patents.

In response to the communication filed April 16, 1906:

In line 3 of the amendment to page 3, line 4, "4" should be 4².

Claims 2 and 3 are objected to on account of the reference to the cutters. The introductory phrase of both claims sets forth that the combination is for an underreamer body, and as such the cutters form no part of said body.

It is suggested that in claim 2, line 2, "its expanded" be changed to *the*.

Claim 3, line 3, "the cutters having straight shanks fitting said ways" should be canceled.

Claim 10 is rejected on Double, 748,054, of record.

The Examiner is unable to see wherein claims 16 and 17 distinguished from Double, 748,054, of record, and said claims are accordingly rejected.

Claims 1, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, and 18, are allowed.

A. P. SHAW, Ex.

MEP

U. S. Patent Office.

289,380, Paper No. 10.

MAY 12, 1906.

Amdt. E.

DIVISION 38.

IN THE UNITED STATES PATENT OFFICE.

Div. 38,

Room 378,

Elihu C. Wilson,

Paper #10.

Under-reamer,

Filed Nov. 28, 1905,

Ser. No. 289,380.

Washington, D. C., May 12, 1906.

Hon. Commissioner of Patents,

Sir: Office letter of May 4, 1906 has been considered.

It is noted that the leader from the character 4³ in Fig. 9 of the drawings is too long. Please remove the end thereof so that the leader will terminate at the right of a vertical drawn from the right edge of the shank 4'.

Please add the character 4³ to the left of Fig. 9 and connect the same by a leader to indicate on the left of the view the bearing corresponding to the one indicated by the character 4³ at the right of the view.

In Fig. 4 apply the character 4³ in at least two places above and below the view and connect said character by a leader to indicate the bearings at the edges of the cutters 4.

Apply the character 4 to indicate the cutter at the left of Fig. 4.

In the specification:

Page 1, line 11, before the period insert:

E¹

—and to leave a maximum open space between the cutters to receive the loose material or sludge, at the bottom of the well or other opening during the operation of drilling.

Claim 2, line 2, change “its expanded” to—the—.

Claim 3, line 3, cancel “the cutters having straight shanks fitting said ways”.

Rewrite claim 10 to read as follows:

E²

10. An under-reamer body terminating in prongs having projecting lugs at their lower ends to hold the cutters apart.

Add the following claims:

E³

19. An under-reamer comprising a body terminating in two prongs, and cutters each having two shoulders and a bearing face on the inner side of each of the two shoulders to engage said prongs.

20. An under-reamer comprising a body terminating in prongs the inner faces of which are provided with straight parallel ways, and cutters having straight shanks fitting said ways, the ends of said prongs terminating in lugs below said ways to spread and hold the cutters apart.

It is believed that in view of the application of the additional characters to Figs. 9 and 4, the Examiner will be able to pass claims 16 and 17. The Double cutter has its bearing face entirely across the cutter instead of on the inner side of the shoulders

at the sides of the shank as specified in these claims.

It is believed that the foregoing places the case in condition for issue.

The final fee has been paid. Please issue the patent at once.

Very respectfully,

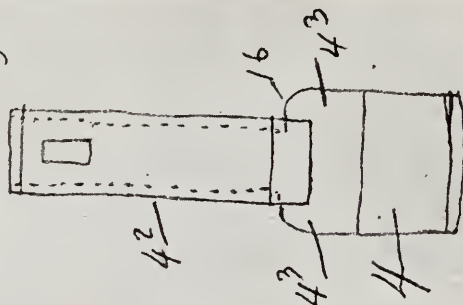
JAMES R. TOWNSEND,

Atty. for Wilson.

289,380

Paper No 11

*Andt (arg)
fig. 9.*

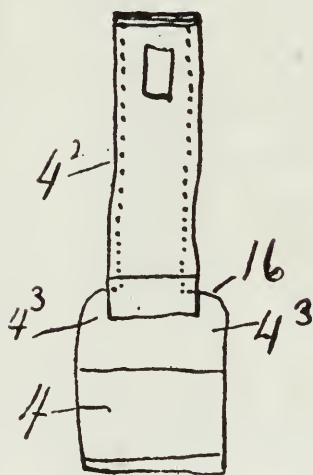


U. S. Patent Off.

MAY 12 1911

DIVISION 38.

Fig. 9.



70 *Wilson & Willard Manufacturing Company*

IN THE UNITED STATES PATENT OFFICE.

Elihu C. Wilson,

Div. 38,

Under-reamer,

Room 378,

Filed Nov. 28, 1905,

Paper 10.

Ser. No. 289,380.

Washington, D. C. May 12, 1906.

Hon. Commissioner of Patents,

Sir: Please amend Fig. 9 of the drawings as indicated by red lines in the accompanying sketch, viz.:

In Fig. 9, add two horizontal lines; one connecting the lower ends of the edge lines of the shank, and the other connecting said edged lines to indicate the angle in the face of the shank as shown in Fig. 7.

You will please prepare and file in the case photo copies of the drawings. (full size).

Charge my account for the service.

Very respectfully,

JAMES R. TOWNSEND,

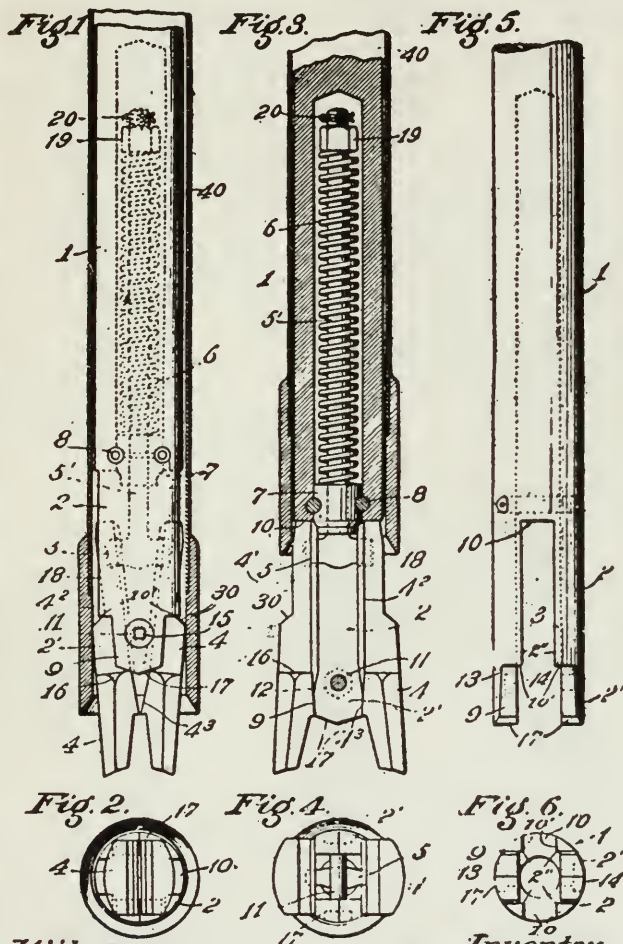
Atty. for Wilson.

Townsend. J. R. C. U. S. Patent Office. Number 101,913. Received May 14, 1906. Chief Clerk. Rec'd. in Div. C. May 15, 1906. Forwarded to mail room, for Div. E. 5/18/06. Mail Room, May 19, 1906. Transfer to Div. E. Received in Div. E. May 19, 1906. Photographs, May 25, 1906. 2 Sheet Drg. Cost, \$ 30¢. 2 Prints ~~mailed~~ filed. Book 26, page 37. T. To Mail Room for Div. C. 5/26/06. Mail Room. May 26, 1906. Transfer to Div. C. Rec'd in Div. D. May 26, 1906. Corrected and forwarded 5/29/06. No chg. Forward to mail room for Div. 38. Mail Room, May 31, 1906. Transfer to Div. 38. U. S. Patent Office. May 31, 1906. Division 38.

289,380
L

219
1

P



Witnesses:
E. C. Hobb
C. J. Williams

Inventor,
Elihu C. Wilson
by James R. Townsend
his atty

289,380
2

Fig. 7.

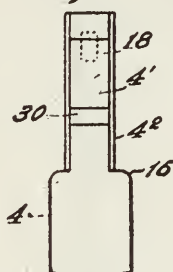


Fig. 8.

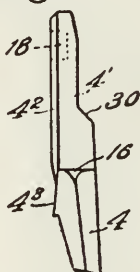


Fig. 9.

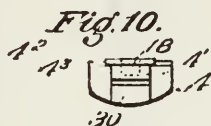
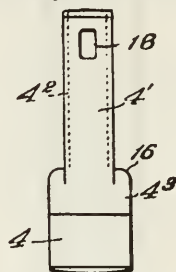


Fig. 11.



Fig. 12.



Fig. 13.



Fig. 14.



Witnesses:

C. C. Kelly
J. G. Williams

Inventor,

Elihu C. Wilson.

By James R. Townsend
his Atty

L. C.

Paper No. 12.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. 38, Room 378.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE.

Washington, D. C., June 7, 1906.

MAILED “ “ “

Elihu C. Wilson,
Care J. R. Townsend,
Bradbury Bldg.,
Los Angeles, Cal.

Please find below a communication from the EXAMINER in charge of your application, for “Underreamer,” filed November 28, 1905, Serial No. 289,380.

F. I. ALLEN,
Commissioner of Patents,

In response to the communication filed May 12, 1906:

Claims 1, 2, 10, 11, 12, 14, 15, 16, 17, 18, and 19, are rejected upon—

Cummings 819,042, May 1, 1906, Artesian & Oil Wells, Reamers.

The remaining claims are allowed.

M.E.P.

A. P. SHAW, Ex.

MEMORANDUM.

OF

FEE PAID AT UNITED STATES PATENT
OFFICE.

CERTIFICATE OF DEPOSIT. MAILED

\$20—RECEIVED. S. Jun. 13, 1906.

Jun. 18, 1906. James R. Townsend.

CHIEF CLERK U. S. PATENT OFFICE.

(Be careful to give correct Serial No.)

Serial No. 289,380, 191

INVENTOR:

Elihu C. Wilson.

Patent to be Issued to:

Elihu C. Wilson.

Name of Invention, as Allowed:

Underreamer.

Date of Payment:

June 13, 1906.

FEE:

\$20.00

Date of Filing:

Nov. 28, 1905.

Date of Circular of Allowance.

The Commissioner of Patents will please apply
the accompanying fee as indicated above.

JAMES R. TOWNSEND,

ADAM,

Attorney.

Send Patent to

JAMES R. TOWNSEND
PATENTS
BRADBURY BLOCK
LOS ANGELES, CAL.

JMH.

Serial No. 289,380

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE.

Washington D. C., June 18, 1906.

Elihu C. Wilson,
c/o James R. Townsend,
430 Bradbury Bldg.,
Los Angeles, Cali.

Sir:

You are informed that the final fee of TWENTY DOLLARS has been received in your application for Improvement in Underreamer.

Date of receipt.

Very respectfully,
F. I. ALLEN,
Commissioner of Patents.

76 *Wilson & Willard Manufacturing Company*

MAIL ROOM 289,380, Paper No. 13.
JUN. 18, 1906. Letter, Affidavit and Print.
U. S. PATENT OFFICE. MAILED
TO PATENT OFFICE.
JUN. 13, 1906.
James R. Townsend.

IN THE UNITED STATES PATENT OFFICE.
Elihu C. Wilson, Division 38
Underreamer, Room No. 378
Filed Nov. 28, 1905, Paper No. 11
Ser. No. 289,380.

Los Angeles, Cal., June 11, 1906.

Hon. Commissioner of Patents,

Sir: I herewith hand you affidavit of the above mentioned applicant, under Rule 75, of fact showing the completion of the claimed invention in the United States prior to the filing date of the patent of A. Cummings, which issued May 1, 1906, and contains no claims to the subject matter contained in this application.

This is done for the purpose of avoiding reference to said patent.

The final fee has been transmitted and I request that the patent be issued at the earliest possible date.

Very respectfully,
JAMES R. TOWNSEND,
Atty. for Wilson.

Enclosures.

T-A.

MAIL ROOM.

JUN. 18, 1906.

U. S. PATENT OFFICE.

MAILED

TO PATENT OFFICE

JUN. 13, 1906

James R. Townsend.

Elihu C. Wilson,

Underreamer.

Filed Nov. 28, 1906.

Ser. No. 289,380.

IN THE UNITED STATES PATENT OFFICE.

State of California,

County of Kern,—ss.

ELIHU C. WILSON, first being duly sworn, deposes and says, that he is the applicant who filed an application for patent for UNDERREAMER, in the United States Patent Office, filed Nov. 28, 1905, Serial No. 289,380.

That on or about the months of January or February, 1904, he made the drawing of the invention set forth and claimed in said application for patent and that a blue print copy of the said drawing is hereto attached and marked "EXHIBIT A E. C. WILSON."

That the said drawing was made in the State of California, and that it was exhibited to the foreman and other employees of the Baker Iron Works of Los Angeles, California, and as soon as the drawing was completed, namely about the months of January or February, 1904, that he caused an underreamer to be made in accordance with said drawing, and that said underreamer was completed by the Baker Iron Works some time prior to the 29th day of March, 1904.

78 *Wilson & Willard Manufacturing Company*

Affiant further makes oath, that he does not know and does not believe that the invention has been in public use or on sale, or printed or described in any printed publication, in this or any foreign country for more than two years prior to his application, and that he never abandoned the invention.

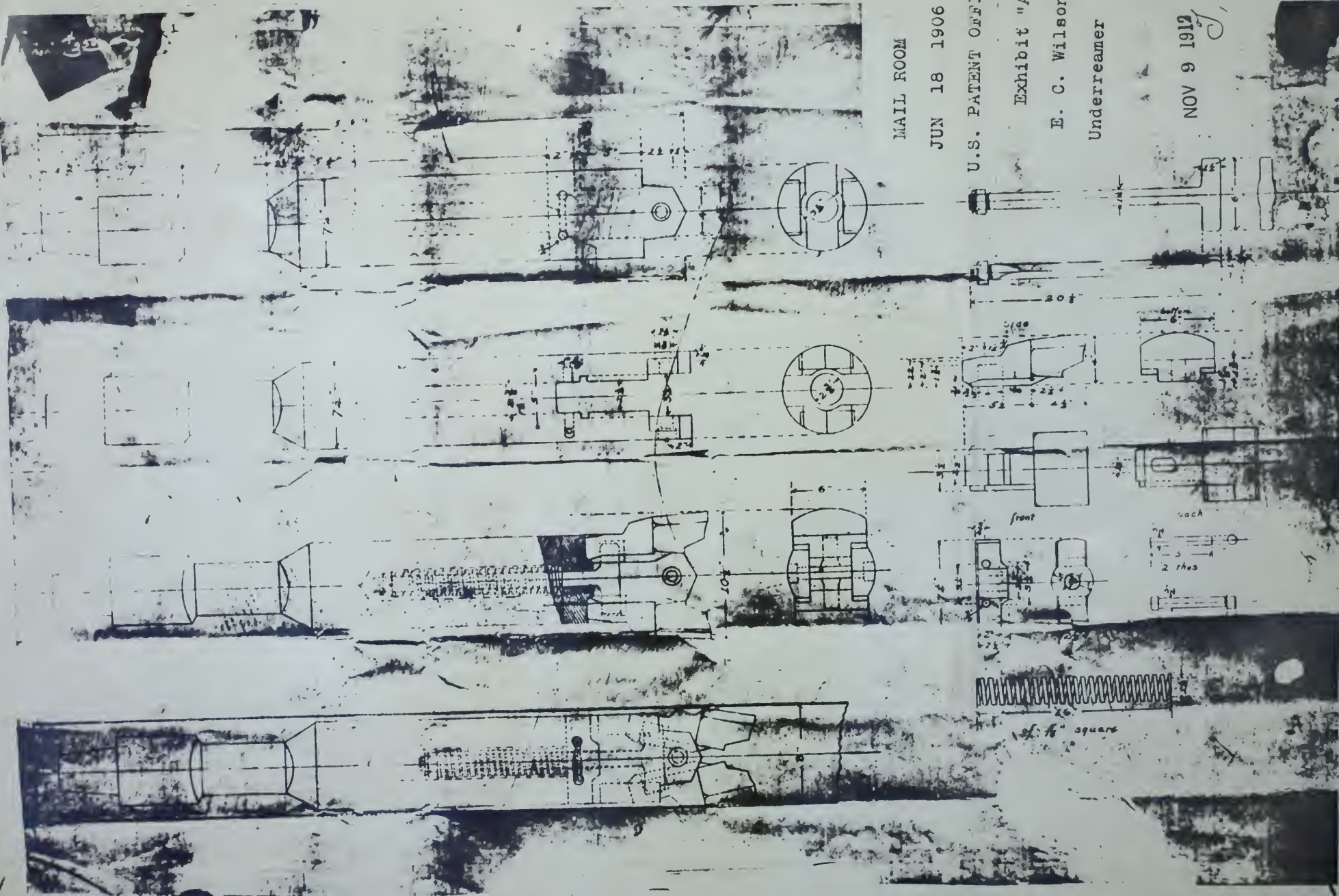
E. C. WILSON.

Sworn and subscribed to before me, this 15th day of June, 1906, at Bakersfield, in the County of Kern, State of California.

[Seal]

H. I. TUPMAN,
Notary Public in and for the County of Kern, State
of California.

My commissioner expires Aug. 18, 1908.



MAIL ROOM

JUN 18 1906

U.S. PATENT OFFICE.

Exhibit "A"

E. C. Wilson

Underreamer

NOV 9 1912



L. C.

Paper No. 14.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. 38, Room 378.

Address only

"The Commissioner of Patents,
Washington, D. C."

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE.

WASHINGTON, D. C. June 23, 1906.

MAILED " " "

Elihu C. Wilson,
c/o J. R. Townsend,
Bradbury Block,
Los Angeles, Cal.

Please find below a communication from the EXAMINER in charge of your application, for "Underreamer," filed November 28, 1905, Serial No. 289,380.

F. I. ALLEN,
Commissioner of Patents. .

In response to the communication filed June 18, 1906:

In line 3 of the amendment to line 4, page 3, 4" should be 4² to agree with the drawing, as required in office letter of May 4, 1906.

The claims are allowed.

MEP.

G. R. IDE,
Actg. Exr.

MAIL ROOM. 289,380, Paper No. 15.
JUL. 3, 1906. Amdt. F.
U. S. PATENT OFFICE U. S. Patent Office.
JUL. 5, 1906.
DIVISION 38.

IN THE UNITED STATES PATENT OFFICE.

MAILED
TO PATENT OFFICE
JUN. 28, 1906.
Division 38.
Room No. 378.
Paper No. 15.

Elihu C. Wilson,
Underreamer, James R. Townsend.
Filed Nov. 28, 1905,
Ser. No. 289,380.

Los Angeles, Cal., June 28, 1906.

Hon. Commissioner of Patents,

Sir: In response to Office letter of June 23, 1906.

Please substitute—4²—for “4” in line 3 of
amendment to line 4 Page 3.

The final fee has been paid. Please issue the patent as soon as possible.

Very respectfully,
JAMES R. TOWNSEND,
Attorney for Wilson.

DOCKET Clerk. Jul. 3, 1906. U. S. PATENT
OFFICE.

A. R.

289,380

ISSUE DIVISION.

All communications should be addressed to

“The Commissioner of Patents,

Washington, D. C.”

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE.

Washington, D. C., July 12, 1906, 190—

Elihu C. Wilson,

c/o J. R. Townsend,

430 Bradbury Bldg.,

Los Angeles, Cal.

Sir: Your APPLICATION for a patent for an
IMPROVEMENT

Under Reamers

filed Nov. 28, 1905, 190—, has been examined and allowed.

The final fee, TWENTY DOLLARS, having been received, the Letters Patent will be forwarded in due order of business.

Additional copies of Specifications and Drawings will be charged for at the following rates: Single copies, uncertified, 5 cents each. The money should accompany the order.

Very respectfully,

F. I. ALLEN,

Commissioner of Patents.

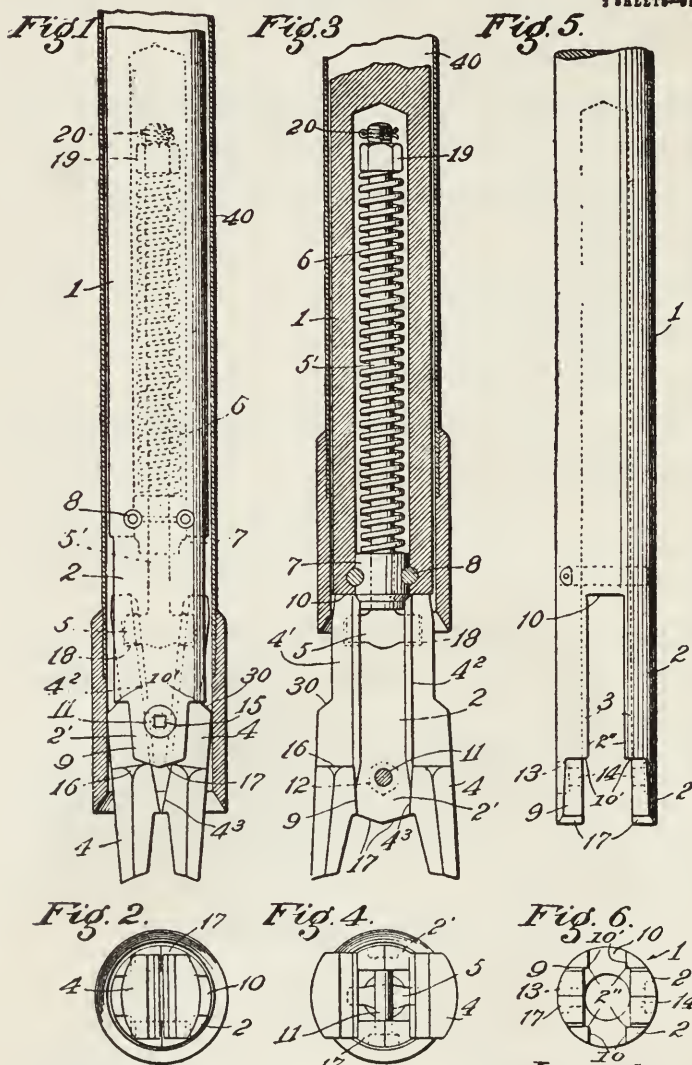
No. 827,595

PATENTED JULY 31, 1906.

E. C. WILSON.
UNDERREAMER.

APPLICATION FILED NOV. 28, 1905.

3 SHEETS—SHEET 1



Witnesses:

b. b. Kelly
b. j. Williams

Inventor,

Elihu C. Wilson
by James R. Townsend
att'y

No 827,595

PATENTED JULY 31, 1906

E. C. WILSON
UNDERREAMER.

APPLICATION FILED NOV 28, 1905

2 SHEETS-SHEET 1

Fig. 7

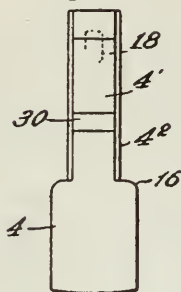


Fig. 8

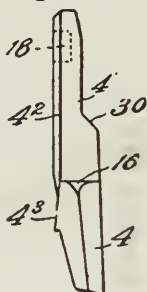


Fig. 9

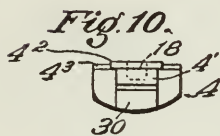
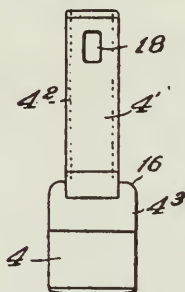


Fig. 11



Fig. 12



Fig. 13.



Fig. 14.



Witnesses:

C. C. Holly
G. J. Williams

Inventor.

Elihu C. Wilson.

G. James P. Townsend
his atty

UNITED STATES PATENT OFFICE.**ELIHU C. WILSON, OF BAKERSFIELD, CALIFORNIA.****UNDERREAMER.****No. 827,595.****Specification of Letters Patent.****Patented July 31, 1906.**

Application filed November 28, 1905. Serial No. 289,380.

To all whom it may concern:

Be it known that I, ELIHU C. WILSON, a citizen of the United States, residing at Bakersfield, in the county of Kern and State of California, have invented a new and useful Underreamer, of which the following is a specification.

Objects of this invention are to provide an underreamer of superior strength and of superior width and expansion of cutters so as to enable reaming as great a portion of the circumference of the hole as possible at each stroke, to insure greater safety against losing the cutters from the body while reaming, to avoid the necessity of a middle joint in the mandrel or reamer body, and to leave a maximum open space between the cutters to receive the loose material or sludge at the bottom of the well or other opening during the operation of drilling.

By this invention it is possible to increase the strength of the cross or T which suspends the cutters.

In this invention a cross or T formed of a single forging is provided for suspending the cutters.

Another decided advantage is simplicity and convenience of attaching and removing the cutters and suspending devices from the reamer-body.

Another advantage is facility of collapsing the cutters. I so construct the mouth of the underreamer as to dispense with stock between the collapsed cutters, thus enabling the cutters to close together. This feature makes extreme expansion possible and makes the use of maximum amount of stock in shanks of cutters possible, thus insuring maximum strength of cutters.

The accompanying drawings illustrate the invention.

Figure 1 is a view of the underreamer in a casing just before it has passed through the shoe of the casing, the parts being collapsed. Fig. 2 is a view looking at the bottom of Fig. 1. Fig. 3 is a view of this newly-invented underreamer in a well, the same having just passed through the casing-shoe and expanded for reaming the hole below. Portions are shown in mid-section. Fig. 4 is a view looking at the bottom of Fig. 3. Fig. 5 is a view of the reamer-body at right angles to Figs. 1 and 2. Fig. 6 is a view looking at the bottom of Fig. 5. Fig. 7 is a front view of a cutter detached. Fig. 8 is an edge view of a cutter at right angles to Fig. 7. Fig. 9 is a

view of the inside or back of the cutter. Fig. 10 is a view looking down on the top of the cutter. Fig. 11 is a view of the cross. Fig. 12 is a view of the cross at right angles to Fig. 11. Fig. 13 is a side view of the spring seat-block detached. Fig. 14 is a bottom view of the same.

1 designates a hollow body of an underreamer terminating in prongs 2, forming a fork, said prongs having shoulders 2' on their inner faces to form ways 3 for cutters. Said prongs are provided with and terminate in downwardly-projecting lugs 2' to spread the cutters apart.

4 designates the cutters, which are interchangeable; 4', the cutter-shank; 4², bearing-shoulders of the cutters to engage inside the ways 3; 4³, expansion bearing-faces of the cutters on the sides of said cutters.

The inner faces of the prongs 2 are parallel, and the sides or shoulders 2', which form the ways 3, are also parallel. The cutter-shank 4' and its bearing-shoulders 4² are straight—that is to say, the sides or edges thereof are parallel and fit the ways 3.

5 is a cross, 5' the stem of the cross, and 6 the spring which actuates the cross. The parts 5 5' constitute spring-actuated means for actuating the cutters to expand the same.

7 is a block forming a seat for the spring 6. One or more dowel-pins 8 may be provided as means for holding the block or spring-seat 7 in place.

9 designates the spreading bearings for holding the cutters 4 apart, and 10 the down-thrust bearings for the cutters. The down-thrust bearings 10' are in the nature of shoulders formed by the edges of the forks at the base of the lugs 2'. The prongs 2 of the body are of substantially one thickness throughout, excepting that they are reduced at their lower ends to form lugs for spreading the cutters 4 apart. The edges of the lugs 2' for the spreading bearings 9 and the prongs terminate abruptly in the shoulders 10' at the base of the lugs 2'. This construction affords the necessary operative structure with maximum strength for minimum weight of body.

11 is a detachable cross-piece in the form of a bolt secured by a nut 12. 13 is an angular socket in the outer face of one of the forks around the bolt-hole 14 in said fork. The nut 12 is conformed to the angular socket, and the bolt 11 is provided with an angular socket 15 in its head to receive a wrench (not shown) for screwing the bolt into the nut.

The expansion bearing-faces 4³ terminate at their upper ends in rounded corners or bearings 16 to ride more readily over the beveled end faces 17 of the downwardly-projecting lugs 2' to engage said bearings for expanding the cutters.

18 designates recesses in the inner faces of the cutters for engaging the ends of the cross 5.

19 and 20 indicate the usual tension-nut for the spring 6 and the cotter-pin for securing the same.

To assemble the underreamer, the block 7 will first be placed on the stem 5' of the cross 5, and the spring 6 is then adjusted and secured in place by the nut 19 and cotter-pin 20. Then the cutters are placed on the ends, respectively, of the cross 5, which seat in the recesses 18 therefor. Then the parts thus assembled are inserted into the hollow mandrel and brought into the position shown in Fig. 3, whereupon the dowel-pins 8 are inserted and the cross-piece formed of the bolt 11 is then inserted. The nut 12 is placed in its angular socket 13, and the bolt or cross-piece 11 is then screwed home. The underreamer is then in condition for operation.

To use the underreamer, the cutters will be drawn down below the downwardly-projecting lugs 2', thus collapsing the same into the position shown in Fig. 1, whereupon the underreamer will be inserted into the pipe or casing in the usual manner and allowed to descend. When it has passed through the shoe, as shown in Fig. 3, the spring operates in the usual manner to draw the cross 5 up, thus bringing the cutters into the expanded position shown in Fig. 3. The rounded shoulders 16 ride readily over the beveled faces 17, and the upper ends of the cutters seat against the downthrust bearings 10, and the bearing-shoulders 4² of the cutters engage the ways 3 of the fork prongs or members 2, thereby being solidly held during the operation of underreaming. The spreading bearings 9 of the lugs 2' engage the expansion bearing-faces 4³ of the cutters at the same time, so that the tool is practically a unit during the operation of underreaming.

30 designates the usual shoulders on the cutters for drawing the same in when the tool is removed through the pipe or casing 40.

It is advisable that the lower ends of the forks 2 should not form downthrust bearings for the cutters, as there would otherwise be a tendency of crystallization of said forks, which is avoided by making the downthrust bearings at 10 only.

The cross-piece 11 serves as a brace for the prongs of the fork and prevents accidental removal of the cutters and T or cross 5.

It is to be noted that by the construction shown the cutters are quickly expanded at the initial upward movement of the same

after escaping the shoe of the casing 40, and that immediately thereafter the cutters are solidly held in the straight and parallel ways 3, and that when the cutters are fully drawn up they seat on the downthrust bearings 10 70 and the spreading bearings 9, while the shanks are rigidly held throughout their length. Said spreading bearings are on the lugs 2', which constitute wedges for wedging the cutters apart, and said bearings are at the 75 sides of the lower ends of the body, thus engaging the outer edges of the cutters to hold the cutters apart and leaving an open space between the middle portions of the cutters for a greater distance upward from the lower 80 ends of the cutters than would be the case were the cutters held apart by any intermediate portion between the lugs.

I term the cutters "shouldered cutters," for the reason that the rounded corners 16, 85 which extend away from the shank at right angles thereto, are in the nature of shoulders, the inner faces 4³ of which engage the spreading faces 9 of the side lugs 2' to brace the cutters and hold them apart. 90

What I claim is—

1. An underreamer-body terminating in prongs having projecting lugs at their lower ends with spreading bearings 9 for holding the cutters apart. 95

2. An underreamer-body terminating in prongs and provided with upper and lower bearings for the cutters, said prongs having projecting lugs, the edges of which form lower bearings for holding the cutters apart, 100 and the ends of said lugs having beveled end faces.

3. An underreamer-body terminating in prongs the inner faces of which are provided with straight parallel ways, the ends of said 105 prongs terminating in lugs below said ways to spread and hold the cutters apart.

4. An underreamer-body terminating in prongs forming a fork, said prongs having shoulders on their inner faces to form ways 110 for the cutters.

5. A hollow underreamer-body terminating in prongs forming a fork having shoulders on the inner faces to form ways for the cutters, cutters in said ways, a cross in said hollow body for operating said cutters, a spring 115 for operating the cross, a block in the body to form a seat for said spring, and one or more dowel-pins securing the block in place.

6. A hollow underreamer-body, cutters, a 120 cross inside the hollow body for operating said cutters, a spring for operating said cross, a block in said body forming a seat for said spring, and one or more dowel-pins for holding the block in place, said block and pins being located entirely above the head of the cross. 125

7. A hollow underreamer-body terminating in prongs forming a fork and provided with ways and downthrust bearings for cut- 130

- ters, cutters in said ways engaging said bearings, a cross for operating said cutters, a spring for actuating said cross, a block forming a guide for the stem of the cross and a seat for the cross-actuating spring, its lower end terminating above the head of the cross and projecting below the downthrust bearings to hold the upper ends of the cutters apart, and means for holding the block in the reamer-body.
8. A hollow underreamer-body terminating in prongs forming a fork, said prongs having shoulders on their inner faces to form ways, cutters in said ways, means for operating the cutters, and a detachable cross-piece connecting the ends of the fork.
9. An underreamer-body terminating in prongs forming a fork and provided with shoulders on the inner faces of the prongs which form cutter-ways and terminate in downwardly-projecting lugs, and cutters mounted between the prongs of said fork and having shoulders inside the fork and faces to bear on the projecting lugs.
10. An underreamer-body terminating in prongs having projecting lugs at their lower ends to hold the cutters apart.
11. An underreamer-body terminating in prongs forming a fork having beveled faces at the ends of its prongs, cutters having shoulders to ride over said beveled faces, and means for suspending said cutters in said body.
12. An underreamer-body terminating in prongs forming a fork, the ends of said prongs being provided with lugs to spread the cutters apart.
13. An underreamer-body terminating in prongs forming a fork, said prongs having shoulders on the inner faces to form ways for the cutters, and said prongs terminating in lugs to act as spreaders for the cutters.
14. A hollow underreamer-body terminating in prongs forming a fork, said prongs terminating in lugs for spreading the cutters, said lugs having beveled ends to engage bearings on cutters to expand cutters.
15. An underreamer-body terminating in prongs forming a fork, said prongs terminating in lugs or projections, said lugs having beveled faces or bearings to expand the cutters, and also faces or bearings for the cutters to rest on after they have expanded to a normal position for reaming.
16. An underreamer-cutter having two shoulders and a bearing-face on the inner side of each of the two shoulders of the cutter.
17. An underreamer-cutter having a shank and a shoulder on either side of the shank of the cutter, each of said shoulders projecting at right angles to the shank of the cutter and having a bearing-face on its inner side.
18. An underreamer having a body terminating in a fork, and cutters suspended between the prongs of the fork, the ends of said prongs constituting wedges to wedge between the cutters.
19. An underreamer comprising a body terminating in two prongs, and cutters each having two shoulders and a bearing-face on the inner side of each of the two shoulders to engage said prongs.
20. An underreamer comprising a body terminating in prongs the inner faces of which are provided with straight parallel ways, and cutters having straight shanks fitting said ways, the ends of said prongs terminating in lugs below said ways to spread and hold the cutters apart.
- In testimony whereof I have hereunto set my hand at Bakersfield, California, this 20th day of November, 1905.
- ELIHU C. WILSON.
- In presence of—
H. I. TUPMAN,
T. E. KLOPSTEIN.

1905

A. O. W.

CONTENTS:

Reamers

Print May 31, 1906.

OK

1/2. Application papers.

1. Amdt. A. Dec. 26-05.
2. Rej. Jan. 9-06. 166. Artesian & Oil Wells
3. Amdt. B. Mar.-12-06. 6. Reamers
4. Rej. Mar. 21-06.
5. Amdt. C. Mar. 27-06.
6. Letter April 3-06.
7. Amdt. D. Apr. 16-06.
8. Amdt. (drg.) Apr. 16-06.
9. Rej. May 4-06.
10. Amdt. E. May 12-06.
11. Amdt. (drg.) May 12-06.
12. Rej. June 7-06.
13. Letter Affidavit Print June 18-06.
14. Letter June 23-06.
15. Amdt. F. July 3-06.
- 16.
- 17.
- 18.
- 19.
- 20.
21. U. S. Patent Office,
22. DEC. 1, 1905.
23. DIVISION 38.

TITLE:

Improvement in Underreamers.

[Endorsed]: No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Complainants' Exhibit Wilson File Wrapper Contents. Filed ———. F. D. Monckton, Clerk.

Complainants' Exhibit Cummings Patent.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. #1540—Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Complainants' Exhibit Cummings Patent." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Complainants' Exhibit Cummings Patent. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 819,042.

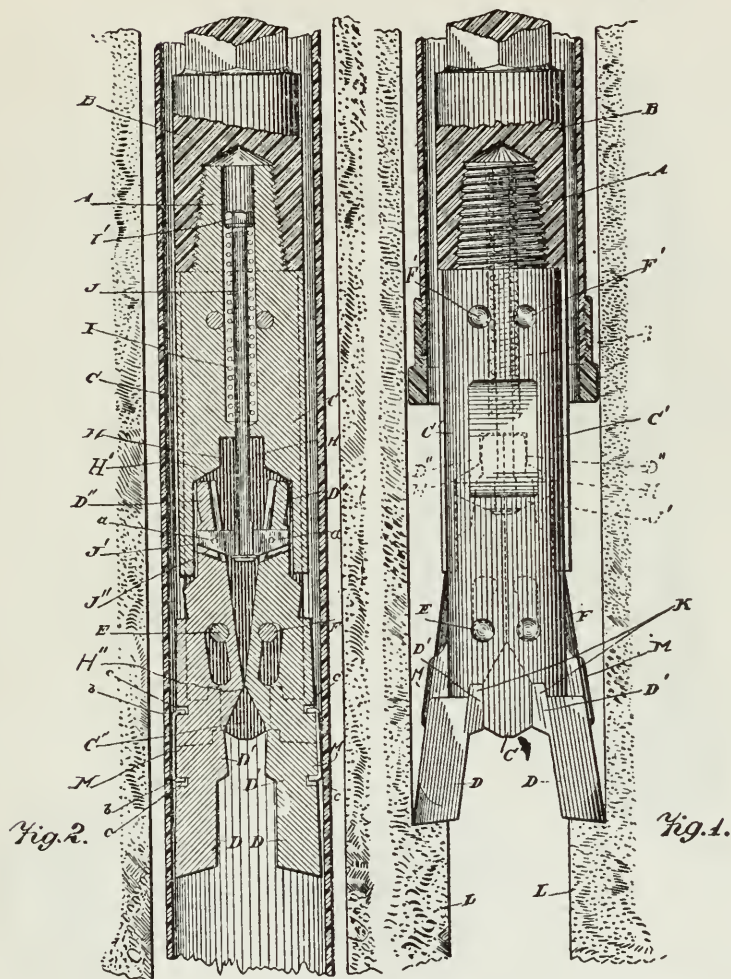
PATENTED MAY 1, 1906.

A. CUMMINGS.

UNDERREAMER FOR MINERAL BORING.

APPLICATION FILED FEB. 25, 1905.

2 SHEETS-SHEET 1.



Witnesses.
Tracy B. Hart, L.
Wadsworth Day.

Inventor.
Alexander Cummings.
 By *Atty. S. John Day*

No. 819,042.

PATENTED MAY 1, 1906

A. CUMMINGS.

UNDERREAMER FOR MINERAL BORING.

APPLICATION FILED FEB. 25, 1905.

2 SHEETS—SHEET 2

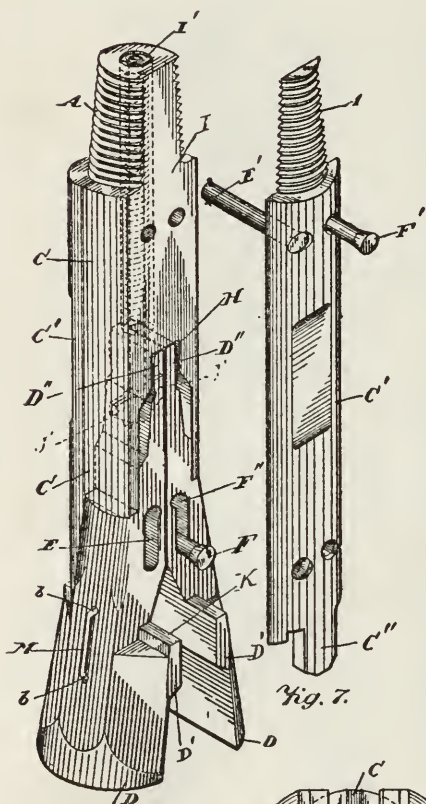


Fig. 6.

Fig. 7.

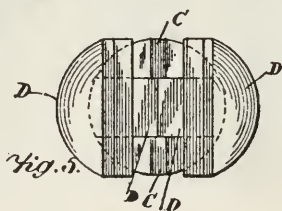


Fig. 8.

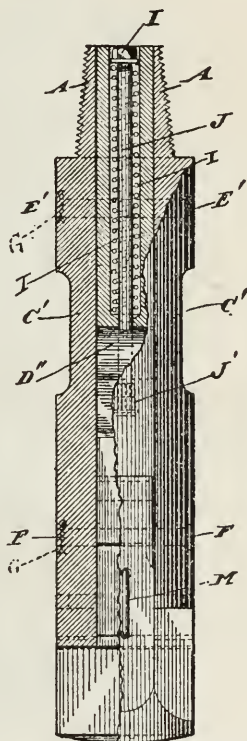


Fig. 9.

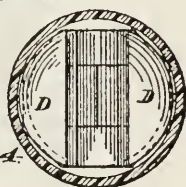


Fig. 10.

Witnesses.
Lucy B. Satoke
Hedassah Day

Inventor.
Alexander Cummings.
By
Atty. S. John Day

UNITED STATES PATENT OFFICE.

ALEXANDER CUMMINGS, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER FOR MINERAL BORING.

No. 819,042.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed February 25, 1905. Serial No. 247,240 1/2.

all whom it may concern:

Be it known that I, ALEXANDER CUMMINGS, of the city of Los Angeles, in the county of Los Angeles, in the State of California, have invented a new or Improved Underreamer for Mineral Boring, of which the following is a full, clear, and exact description or specification, reference being had to the annexed drawings, and to the letters marked thereon.

This invention, which relates to certain new and useful improvements in the construction and operation of underreamers, such as are used in enlarging a bore-hole or well which has been drilled in mineral formations or strata of the earth's crust, consists of a pair of cutting-jaws which are capable of being closed sufficiently to enable the underreamer to be lowered through the casing which is usually employed to line and protect such bore-holes or wells. These jaws are each pivoted to the upper part of the device by which the cutting edges of the underreamer are connected to the rods of the mineral-boring apparatus, and these parts are otherwise so constructed that while during descent of the underreamer within the casing the jaws are closed together and prevented from bearing directly against the interior of the casing, yet the cutting parts of the jaws are free to open outward to the width necessary for the underreaming operation so soon as the underreamer has passed downward and sufficiently far below the bottom of the casing to enable the underreaming operation to be proceeded with.

Upon the annexed drawings, Figure 1 is an elevation of my new or improved underreamer, showing the cutting-jaws in their fully-opened position and as they appear and are situated in the act of underreaming a bore-hole below the casing or lining shown in the upper part of the figure in transverse section, the lower part of the auger-stem to which my new or improved underreamer is connected by a tapered screw in the ordinary manner being also shown in transverse section. Fig. 2 is a vertical section of my new or improved underreamer, showing the cutting-jaws and all the other parts of the device in the position which they occupy when within the casing of the bore-hole or well. Fig. 3 is a view of my new or improved underreamer, partly in elevation and partly in transverse section, showing the same at right angles to Figs. 1 and 2. Fig. 4 is a transverse section of the casing, showing the bottom of

the underreamer as it appears when descending through or inclosed within the casing. Fig. 5 is an inverted plan of the bottom of the underreamer, showing its cutting-jaws opened out to their full width or in their operating position corresponding to Fig. 1. Fig. 6 is a perspective view of my new or improved underreamer, showing one of the detachable parts thereof removed in order to the better display the construction of the interior parts of the device. Fig. 7 is a perspective view of one of the lateral detachable parts.

As shown by Figs. 1 to 7, my underreamer is attached to the ordinary auger-stem by means of a tapered screw A, screwed into the socket B. The stock or body of the underreamer comprises a part C, between the lateral parts C' of which the cutting-jaws D are disposed, pins E and F extending transversely therethrough. Pins E and F aside from assisting in guiding the jaws in their movement within the stock also cooperate with the pins E' and F' to securely connect the lateral pieces C' with the part C. The lower and upper pins E F and E' and F' are preferably formed with tapered heads at one end fitting into corresponding holes in the sides C' C', as shown in the drawings, while through a hole in the opposite end of each a split pin G is passed to prevent the respective pins from in any way falling out of the holes in which they are contained.

The jaws D are held in their open position (shown at Figs. 1, 5, and 6) by the lower portion C'' of each lateral piece C', becoming situated between the parts D' when the jaws D are drawn into their uppermost position—that is to say, with the upper parts D'' D'' bearing against the top and between the sides of the recess H, as shown dotted in Fig. 1 and in full lines in Figs. 3, 5, and 6.

The inner walls of the reamer at H' H' are shouldered or inclined at an angle adjacent to the recesses H H to engage the upper ends D'' D'' of the jaws when the latter are in the lowered position. (Shown in Fig. 2.) At intermediate points H'' upon their adjacent faces the jaws D are formed with angular engaging portions in pivotal contact, the action of the jaws when moved in a vertical direction within the body of the reamer being to rock upon each other, the lower or cutting ends of the jaws being expanded and the upper ends D'' D'' retracted, or vice versa, as a consequence of the engagement of said ends D'' with the inclined shoulders H'.

The cutting-jaws D are drawn upward into open position by the action of the compressed spring I against the washer beneath the nut I', forcing the rod J and its cross-tail J' (whose ends are within the slots J'', Fig. 2, formed in the top of each cutting-jaw D) upward and in such relationship of the parts that the cutting-jaws D D are not only open fully outward into their cutting positions, as shown on the drawings, but are maintained in the cutting positions by the action of the spring I, the rod J, and the cross-tail J'', holding the cutting-jaws D D in close contact with the lower ends of the lateral pieces 15 C' and the upper prolongations D'' D'' of these jaws in hard contact with the top of the recess H.

For the more securely holding of the cutting-jaws D D in their operative positions 20 each jaw has vertical projections K, which enter into corresponding recesses in the lower end of each lateral piece G'. The slots E'' and F'' in each jaw-piece, respectively, are constructed with the upper end of each of 25 these slots widening inward, as shown particularly at Figs. 1, 2, and 6, the reason for this extension of these slots in the manner and directions shown in the drawings being to prevent the pins E and F from impeding the 30 moving of the jaws D D into their closed position when the jaws are drawn downward or outward from the other parts of the underreamer device—as, for example, when entering it into the casing B, when lowering the underreamer down the casing B, or in drawing it 35 upward into and through the casing B—when the bore-hole is ready for the chips and sand accumulated therein from the underreaming operations to be removed by lowering the sand-pump or equivalent device, as is well 40 understood in the practice of mineral boring.

The cross-tail J' has a rod-receiving opening of the proper shape to receive the end of the spring-actuated rod J, the latter being 45 swaged with a rounded head and ribs on opposite sides of said head to prevent rotation of the rod when the nut I' is being placed in position thereon.

To prevent the cutting edges of the jaws 50 D D from coming into contact with the inner surface of the casing C, either when being lowered or being raised through the casing B, each jaw D may be fitted with a removable contact-piece M, which is thick enough to 55 bear with its outer narrow edge against the interior of the casing B, while the inner edge bears against the outer parts of the jaws D D and their connections, as shown at Fig. 2, thus maintaining the cutting edges of the 60 jaws out of contact with the interior surface of the casing B while the underreamer is being passed therethrough.

The contact-pieces M are readily detachable and the ends thereof are bent angularly 65 to enter holes c c, spaced apart upon the outer

faces of the jaws. These contact-pieces are constructed of various sizes of either square or round rods, the size of the rod employed determining the distance between the cutting-jaws and the casing. The cutting-jaws, 7 as shown, are formed angular upon their outer faces and are rounded at the base adjacent to their cutting edges to permit the jaws to be more readily withdrawn and inserted into the casing. 7

It is to be understood that in place of constructing the sides C' of the body C of the underreamer removable or detachable, as hereinbefore described and shown on the drawings, the sides C' may also be in one solid 8 piece of metal with the central body part C, in which case the upper pins E' F' are not used.

Having described my invention, what I claim, and desire to secure by Letters Pat- 8 ent, is—

1. In an underreamer, a body having a recess extending upwardly into its lower end, a pair of jaws vertically movable in the recess and having tilting engagement with each 9 other, the sides of the jaws being in firm sliding contact with the walls of the recess, and means for actuating the jaws to cause the upper ends thereof to contract simultaneously with the expansion of their lower ends, substantially as shown and described. 9

2. In an underreamer, a body having a recess extending upwardly into its lower end between lateral portions thereof, a pair of jaws in tilting engagement with each other, 1 having free vertical movement between said lateral portions but held from sidewise movement by said lateral portions, means for actuating the jaws to cause the upper ends thereof to retract simultaneously with the 1 expansion of their lower ends, and transverse guide-pins carried by the lateral portions of the body adapted to engage the jaws to guide them in their movement, substantially as shown and described.

3. In an underreamer, a body provided with a socket at its lower end, a pair of jaws vertically slidable in said socket and provided upon their adjacent faces with angular fulcrum portions in contact, said jaws also having slots adjacent to their fulcrum portions, guide-pins carried by the body and extending through said slots, resilient means for holding said jaws normally in raised position in the socket in the body, and means for 1 actuating the jaws to cause the upper ends thereof to retract simultaneously with the expansion of the lower ends thereof, substantially as described.

4. In an underreamer, a body having projection portions C' and provided with recesses adjacent to said portions, a pair of jaws slidable in the lower end of the body and in tilting engagement with each other, means for normally maintaining said jaws in ele- 1

vated position in the body, and lateral portions upon said jaws engaging the sides of the portions C" and entering the recesses adjacent thereto to hold the lower ends of the jaws apart when elevated, substantially as described.

5. In an underreamer, a body having a socket at its lower end, a pair of jaws in said socket in tilting engagement with each other, said jaws having slots adjacent to the tilting portions, guide-pins carried by the body and extending through the slots in the jaws, means for holding the jaws normally in raised position, means for expanding the lower ends of the jaws when in raised position, and portions C" upon the body disposed between the lower ends of the jaws and adapted to positively hold the latter expanded when raised, substantially as described.

6. In an underreamer, a body, a pair of jaws vertically slidable in the body, means for normally holding said jaws in raised position, means for expanding the lower ends of the jaws when in raised position, and inter-engaging portions disposed at the lower end of the body and on the sides of the jaws to positively hold the latter expanded when in raised position, substantially as described.

7. In an underreamer, a body provided with downwardly-projecting portions C" at its lower end, a pair of jaws vertically movable in the body and in tilting engagement with each other, means for normally holding said jaws in raised position, and laterally-projecting portions upon said jaws adapted to contact with the portions C" when the jaws are raised to positively hold the latter open, substantially as described.

8. In an underreamer, a body having a socket provided with recesses H at its upper end and having the inclined shoulders H' adjacent to said recesses, said body having the projection C", and upwardly-extending recesses at the sides of the projection C', a pair of jaws disposed in the socket in the 45 body, each jaw having a shank the upper end of which is adapted to engage one of the inclined shoulders H' and be guided into the recess H, projections K on opposite sides of each jaw adapted to enter the recesses at the 50 sides of the portions C", said jaws also having contacting angular portions upon their adjacent faces, a spring-actuated rod disposed axially in the upper end of the body, and a cross-tail carried at the lower end of 55 said rod adapted to engage the upper ends of the jaws, substantially as described.

9. In an underreamer, a body provided with a socket, a pair of jaws slidably mounted in the socket in pivotal contact with each 60 other, said jaws being provided on their outer faces with a pair of spaced perforations, and detachable contact-pieces adapted to be interposed between the face of the jaws and the well-casing, said contact-pieces consist- 65 ing of metal bars having angular bent ends adapted for insertion into said spaced perforations, substantially as described.

In testimony whereof I, the said ALEXANDER CUMMINGS, have hereunto set my hand 70 and seal, at Los Angeles aforesaid, in the presence of two subscribing witnesses.

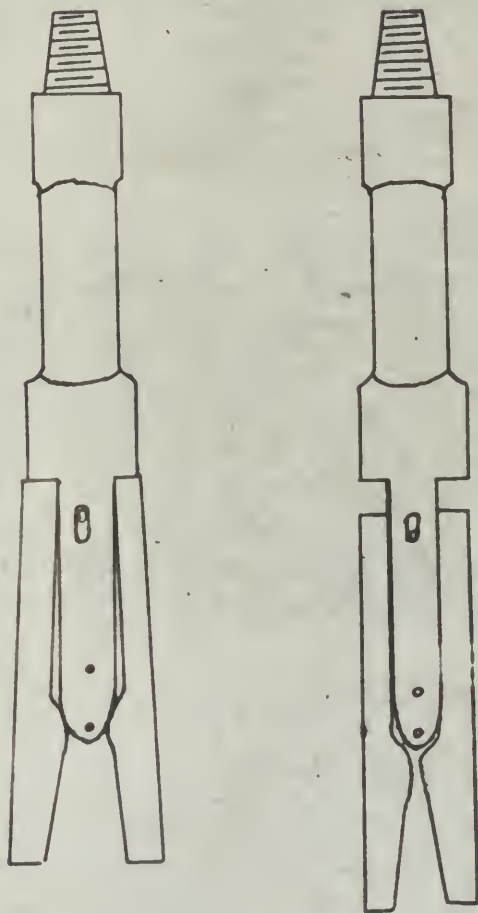
ALEXANDER CUMMINGS. [L. s.]

Witnesses:

ST. JOHN DAY,

HADASSAH DAY.

CANADIAN UNDER REAMER



Position of slips for lowering,
when Reamer strikes bottom breaks
locking pin & spreads slips as shown.

OIL WELL SUPPLY CO.
PITTSBURG, PA.,
U.S.A.

Not recommended for cable tool
Nov. 15 1902.

[Endorsed]: C. C.—1540. Union Tool Co. vs. Wilson & Willard Mfg. Co. Complainant's Exhibit Blue Print of Oil Well Supply Co. Canadian Under Reamer, 1902. Filed Feb. 25, 1916. Wm. Van Dyke, Clerk. F. F. Greely, Deputy.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Complainant's Exhibit Blue Print of Oil Well Supply Co. Canadian Under-reamer. Filed May 8, 1917. F. D. Monckton, Clerk.

Defendant's Exhibit O'Donnell & Willard Patent.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., Southern Division. No. 1540. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. Defendant's Exhibit O'Donnell & Willard Patent. Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit O'Donnell & Willard Patent. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 762,435.

PATENTED JUNE 14, 1904.

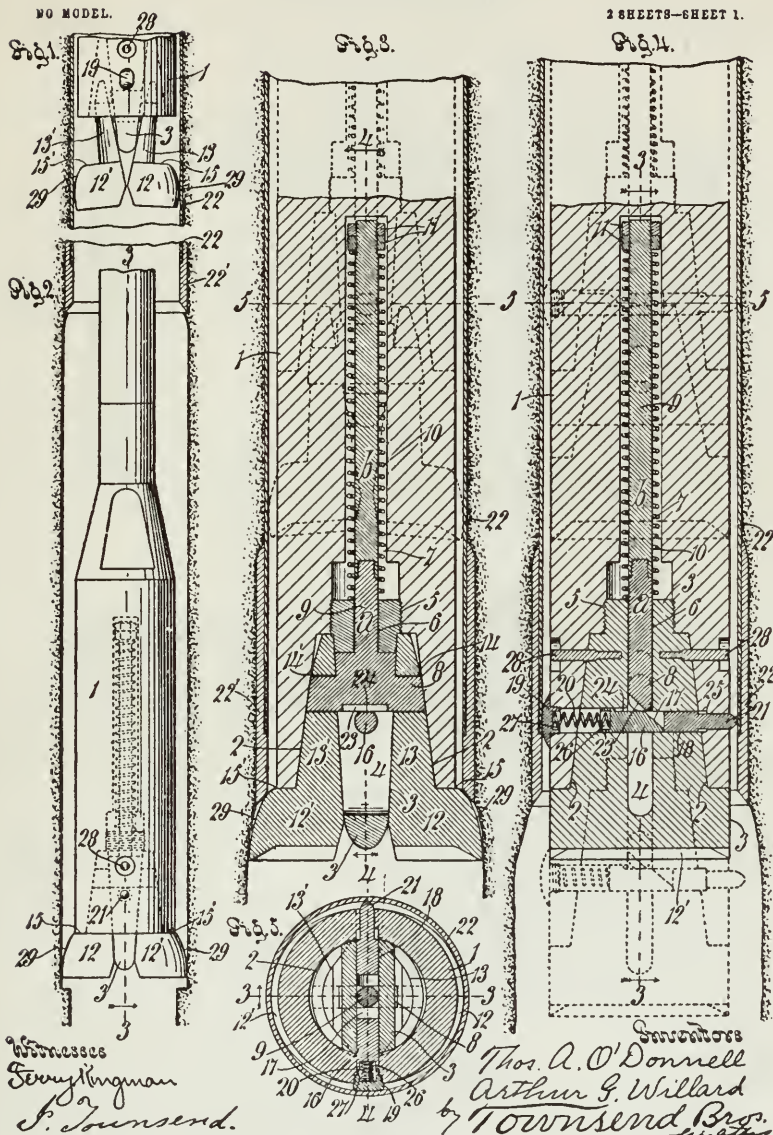
T. A. O'DONNELL & A. G. WILLARD.

UNDERREAMER AND DRILL.

APPLICATION FILED DEC. 9, 1899.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses
 Henry Kingman
 J. Townsend.

THOS. A. O'DONNELL
 ARTHUR G. WILLARD
 TOWNSEND BROS.

No. 762,435.

PATENTED JUNE 14, 1904.

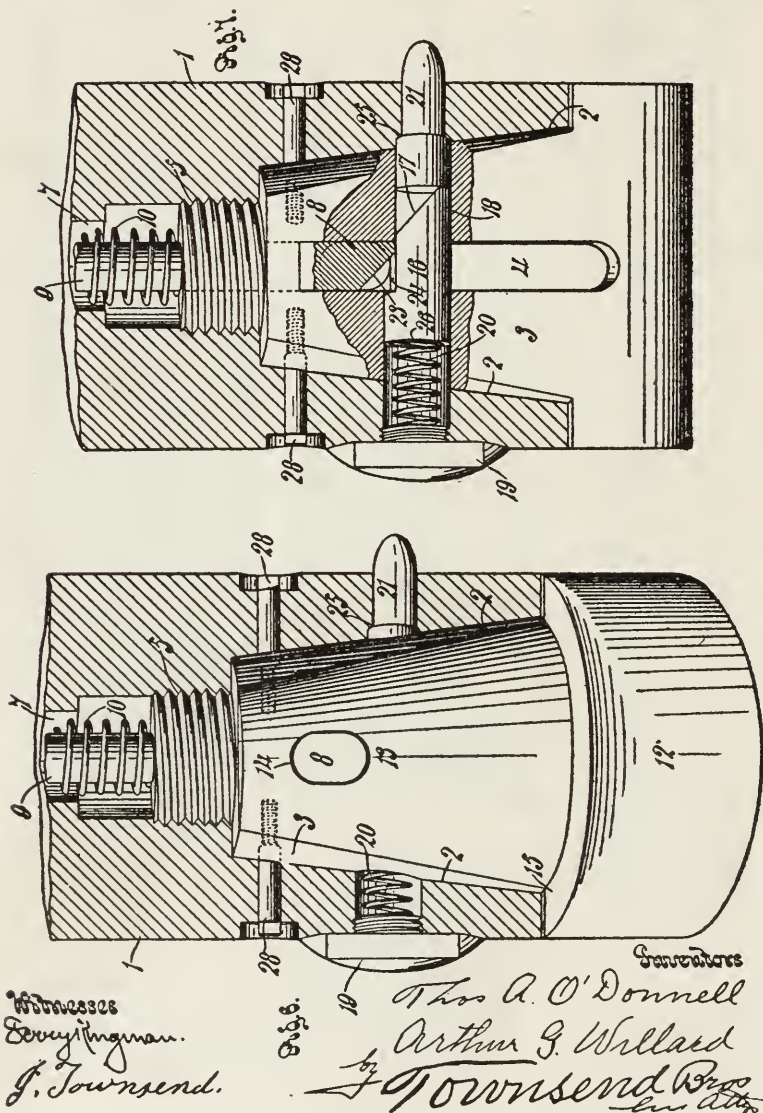
T. A. O'DONNELL & A. G. WILLARD.

UNDERREAMER AND DRILL.

APPLICATION FILED DEC. 8, 1899.

NO MODEL.

2 SHEETS—SHEET 1.



No. 762,435.

Patented June 14, 1904.

UNITED STATES PATENT OFFICE.

THOMAS A. O'DONNELL AND ARTHUR G. WILLARD, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER AND DRILL.

SPECIFICATION forming part of Letters Patent No. 762,435, dated June 14, 1904.

Application filed December 8, 1899. Serial No. 739,712. (No model.)

all whom it may concern:

Be it known that we, THOMAS ARTHUR O'DONNELL and ARTHUR GAY WILLARD, citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Underreamer and Drill, of which the following is a specification.

The object of our invention is to provide an underreamer and drill which can be readily lowered through a casing smaller than the hole to be drilled and which in operation will expand below the casing and will ream out and drill a hole below the casing larger than the casing and which can invariably and without difficulty be drawn up through the casing whenever it is so desired. This underreamer is adapted for use in all kinds of formation and in deep wells, such as oil-wells and Artesian wells. A difficulty to be avoided in the use of underreamers is the liability of damaging the shoe or lower end of the casing when it is attempted to ream close to the casing.

One object of our invention is to avoid any danger of such injury to the casing when reaming close to the casing, but at the same time providing for the positive locking of the jaws while they are below the casing. It is very important in the operation of underreamers that the jaws shall be positively locked when they are working underneath the casing, so that there shall be no looseness of parts and the liability of the jaws being crowded together failing to cut.

Another object of our invention is to so construct the underreamer that there will be no openings through which dirt can get into the inside of the underreamer to cause clogging and unnecessary wear.

Another object of our invention is to provide for the absolute automatic operation of the locking and unlocking device, so that whenever the reamer passes below the casing it will immediately expand and positively lock, and whenever it is drawn upward sufficiently to cause the jaws to engage the casing the jaws will collapse and pass into the casing without any obstruction.

The accompanying drawings illustrate our invention.

Figure 1 is a fragmental view showing a side elevation of the lower end of our underreamer as it appears in passing down inside the well-casing. In this view the side of the stock which is at the left in Fig. 4 is shown. Fig. 2 is a like view showing the underreamer in operation below the casing. In this view the side of the stock which is at the right in Fig. 4 is shown. Fig. 3 is a vertical mid-section on line 3 3, Figs. 2, 4, and 5. Fig. 4 is a vertical mid-section on line 4 4, Figs. 3 and 5. Fig. 5 is a sectional plan on a plane cutting through the locking-bolt. The plane of this section is indicated by the line 5 5, cutting through the dotted position shown in Figs. 3 and 4. Fig. 6 is a fragmental perspective detail view showing the interior parts, which are detachable from the stock. A fragment of the stock is shown in vertical mid-section. Fig. 7 is a like fragmental perspective view illustrating the interior parts in further detail.

1 indicates the stock, provided with an upwardly-tapering frusto-conical socket 2 in its lower end, which socket is practically formed into two tapering sockets by a vertically-slotted wedge-shape partition 3, extending across the socket 2 of the stock and fitted at its opposite edges to the socket and provided with a transverse slot 4. The upper end of the partition 3 is screw-threaded, as at 5, and screwed into the stock.

6 indicates a way through the upper end of the partition, leading from the slot 4 into a spring-chamber 7, provided in the stock above the partition.

8 indicates a cross-head in the slot and provided with a stem 9, extending through the way 6 into the spring-chamber.

10 indicates the spring in the spring-chamber for, normally holding the stem up.

11 indicates nuts on the upper end of the stem to rest upon the spring.

12 indicates a jaw member provided with a tapering shank 13 to fit in one of the tapering shank-sockets formed between the partition 3 and the wall of the tapering socket 2 in the end of the stock. The shank 13 is provided with a cross-head socket 14 in the extended plane of the slot 4 of the partition. The jaw member is provided with a shoulder 15 to fit

against the lower end of the stock when the shank is fully seated in the tapering socket. 12' indicates a like jaw member provided with the shank 13', cross-head socket 14', and shoulder 15', and said jaw member 12' is arranged with its shank in the other socket formed therefor between the partition 3 and the wall of the tapering socket 2. The cross-head 8 is arranged to play in the slot 4, and its opposite ends are inserted in the cross-head sockets 14 14', so that the two jaw members are carried by the spring 10 through the medium of the stem and cross-head.

16 indicates a spring-pressed bolt normally extending across the slot 4 in the path of the cross-head 8 to lock the cross-head against lowering. In Fig. 3 the normal locking position of this bolt is indicated in dotted lines at the lower end of the view. The outer end of the bolt is provided at its upper side with a beveled face 17, which is normally chambered in a portion of the bolt-hole 18, which extends through the partition and through the stock, being closed at one end by a screw-plug 19.

20 indicates a spring in the bolt-hole to normally hold the bolt 16 normally inserted across the slot 4 with its beveled portion 17 fully beyond the slot.

21 indicates a bolt-retracting pin mounted in the bolt-hole and normally projecting from the side of the stock to be engaged and thrown by the well-casing 22 to bring the bolt 16 into position shown in solid lines in Fig. 4, with the beveled face 17 of the bolt in the path of the cross-head 8. The cross-head 8 has a beveled face 23 to engage the beveled face 17 of the bolt when the bolt is in its retracted position. (Shown in solid lines in Fig. 4.)

24 The spring 10 is of sufficient strength to normally hold the jaws 12 12' in their up-drawn position, with their shanks fully seated in the sockets therefor. The bolt-hole 18 is larger at the end which is closed with the plug 19 than at the opposite end, and shoulders 24 and 25 are provided to respectively prevent the bolt and the bolt-retracting pin from being thrown too far by the force of the bolt-spring 20. Preferably the bolt 16 is provided with a chamber 26 to seat one end of the spring 20, and the spring-holding plug 19 is provided with a like chamber 27 to seat the other end of the spring 20.

For convenience in assembling the parts 55 the cross-head stem 9 is made of two parts, one of which, *a*, is integral with the cross-head and the other, *b*, is screwed to the part *a*. The part *a* of the stem together with the cross-head are of less length than the slot 4, and said stem is of greater length than the way 6, so that the part *a* and cross-head 8 can be inserted into the slot and the section *a* then pushed up through the way 6. Then the section *b* of the stem 8 is screwed onto the section *a*, after which the spring is placed in

position and the nuts 11 screwed down into place to give the appropriate tension to the spring which rests upon the upper end of the partition 3. Then the jaws 12 12' are placed against the sides of the partition with their sockets 14 14' caught over the ends of the cross-head 8, and the parts thus assembled are inserted into the conical socket 2 and turned to screw the screw-threaded upper end of the partition into the screw-threaded part therefor in the stock. 28 indicates a screw inserted through the stock and screwed into the partition to prevent the partition from unscrewing. After the parts have thus been assembled the bolt-retracting pin 21 is inserted into the bolt-hole and guideway 18. Then the bolt 16 is inserted into the bolt-hole 18 and the spring 20 is brought into place and the plug 19 screwed home. The tool is then in condition for operation.

In practical operation in order to start the tool down into the well through the casing 22 the workman will first push the bolt-retracting pin 21 in into the position indicated in solid lines in Fig. 4 and then will draw the jaws 12 12' down into the position indicated in Fig. 1. Then the tool will be let down into and allowed to pass through the casing. It is to be observed in Figs. 1 and 4 that the jaws are rounded, as at 29, so that the cutting edge of the jaws are returned when the jaws are in their down-drawn position, so that the cutting edges will not touch the casing during the descent of the tool. When the tool has passed beyond the shoe 22' of the casing, the spring 10 draws the cross-head up, thus drawing the bits up into their socket in the stock. The jaws engaging the walls of the well will be held thereby sufficiently so that the downward stroke of the stock assists the action of the spring to seat the jaw-shanks firmly in their sockets, thus bringing the shoulders 15 15' to fit firmly against the end of the stock. The spring 20 throws the bolt 16 and the pin 21 so that the beveled face 17 of the bolt is chambered in the partition, and the cross-head is thus effectually locked against drawing out of the stock on the upstroke of the stock. Whenever the tool is drawn upward so far that the pin 21 is again forced in by the shoe 22' of the casing, the bolt is thrown into its unlocking position, so that when the shoulders 15 15' of the jaws engage with the shoe 22' the cross-head is free to slip in the stock, thus to allow the stock to be drawn up while the jaws collapse into the position indicated in solid lines in Fig. 1 and in dotted lines in the upper position in Fig. 3. The tool can therefore be readily drawn out through the casing and can be lowered and raised at pleasure, and whenever it is below the casing it is ready for effective operation, as before described.

The partition 3 is flat-faced and holds the jaws spread apart when the shanks are fully

seated in the shank-sockets. The ends of the cross-head have sufficient play in their sockets to allow the jaws to swing freely toward each other as the shanks withdraw from the shank-sockets.

The bolt and its retracting-pin are to be located as close as possible to the shoulders and the cutting edges of the jaws, so that the jaws may become locked as soon as possible after passing below the lower end of the casing and will work in locked position very close to the bottom of the casing, and yet will always be fully unlocked before the shoulders can injure the bottom of the casing on an upstroke.

What we claim, and desire to secure by Letters Patent of the United States, is—

1. An underreamer comprising a stock provided with two tapering sockets in its lower end, a vertically-slotted wedge-shaped partition between the sockets, and having bolt-holes opening from the slot axially in line with each other below the top of such sockets, such stock being also provided with a spring-chamber above the partition; a jaw member provided with a tapering shank to fit in one of said sockets, and also provided with a shoulder to fit against the lower end of the stock when the tapering shank is seated in its socket, said shank being provided with a cross-head socket in the extended plane of said slot; a like jaw member having its shank seated in the other socket of the stock; a cross-head to play in the slot and having its opposite ends seated in the sockets of the shanks, respectively, and having a stem extending up into the spring-chamber; a spring in said chamber for normally holding up the stem, cross-head and jaws; a spring-pressed bolt normally extending across the slot in the path of the cross-head to lock the cross-head against lowering, said bolt having at the upper side of its end, a beveled portion normally chambered in the partition; a spring for normally holding the bolt in its locking position; and a bolt-retracting pin mounted in the bolt-hole and normally projecting from the side of the stock to be thrown by the well-casing to bring the bolt into position with the beveled portion of the bolt in the path of the cross-head.

2. The combination of a stock provided with a tapering socket in its lower end and with a spring-chamber above said socket and with a screw-threaded portion between said spring-chamber and said socket; a wedge-shaped partition fitted in the socket of the stock and provided with a transverse slot and screwed into the stock and provided with a way leading from the slot through the upper end of the partition; a cross-head in the slot and provided with a stem extending through the way into the spring-chamber; a spring in the spring-chamber for normally holding the stem up; two jaw members carried by the cross-head on the opposite sides of the parti-

tion and each provided with a tapering shank to fit the stock-socket on opposite sides of the partition and also provided with a shoulder to engage the lower end of the stock when the shanks are seated in their sockets in the stock; a spring-pressed bolt to play across the slot in the partition and provided with a beveled portion at the upper side and outer end; and a bolt-retracting pin mounted in the stock and normally projecting from the side of the stock to be thrown by the well-casing to bring the bolt into position with the beveled portion of the bolt in the path of the cross-head.

3. In an underreamer, the combination with a jaw-carrying head having a transverse guideway, of a locking-bolt for said head arranged in said guideway; a pin sliding in said guideway to retract the bolt to unlock the head; a stop for said pin being provided in the guideway; and a spring to normally press the bolt toward the stop and into locking position, and to project the pin from the head to be returned by contact with the casing.

4. An underreamer-stock provided with a socket in its lower end; a slotted, downwardly-tapering partition rigidly fixed in the socket to form two shank-seating sockets to seat the shanks of two jaws on opposite sides of said partition; a jaw on each side of said partition and a jaw-carrying head moving in the slot of said partition.

5. An underreamer comprising a stock, the lower end of which has two upwardly-tapering shank-seating sockets with a flat-faced downwardly-tapering partition rigidly fixed between said shank-seating sockets; a vertically-movable cross-head in the slot of the partition; shouldered jaws carried by said cross-head; and an upwardly-tapering shank for each socket.

6. An underreamer comprising a stock provided with a socket in its lower end; a stationary slotted partition fastened in the socket and extending from side to side thereof to form two shank-seating sockets to seat the shanks of two jaws on opposite sides of said partition; a jaw-carrying head moving in the slot of said partition; means for yieldingly holding said head up; and jaws carried by said head and having shanks seated in said sockets.

7. An underreamer comprising a stock provided with a plurality of tapering sockets in its lower end; a stationary, vertically-slotted partition separating the socket; a jaw member; a tapering shank for said jaw member, said shank being provided with a cross-head socket in the extended plane of said slot; a like jaw member having its shank seated in an opposite socket of the stock; a cross-head to play in the slot and having opposite ends seated in the sockets of the shanks, respectively, and having an upwardly-extending stem; means for yieldingly holding up the stem cross-head and jaws; a spring-pressed bolt normally extending across the slot in the path of the cross-

head to lock the cross-head against lowering,
said bolt having at its upper end a beveled
portion; a spring for normally holding the
bolt in its locking position; and means adapt-
5 ed to be engaged by the well-casing to bring
the bolt into position with the beveled portion
thereof in the path of the cross-head.

In testimony whereof we have signed our

names to this specification, in the presence of
two subscribing witnesses, at Los Angeles,
California, this 28th day of November, 1899.

THOS. A. O'DONNELL.

ARTHUR G. WILLARD.

Witnesses:

JAMES R. TOWNSEND,

FRANCIS M. TOWNSEND.

Defendant's Exhibit Swan Patent 683,352.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. No. 1540—In Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit Swan Patent 683,352." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Swan Patent 683,352. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 683,352.

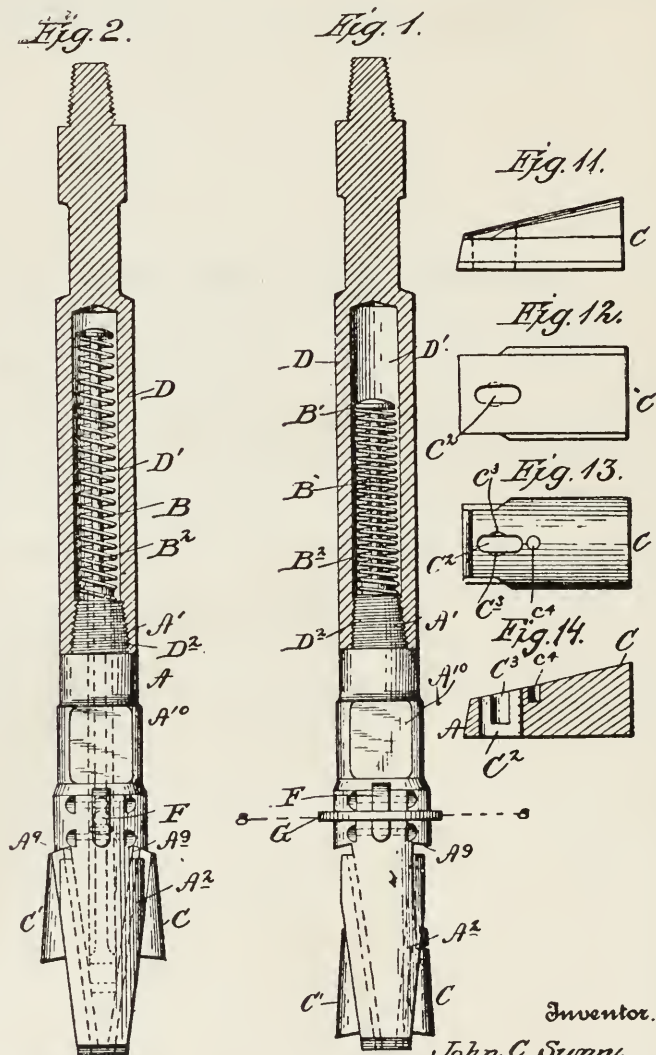
Patented Sept. 24, 1901.

J. C. SWAN.
UNDERREAMER.

(Application filed Dec. 10, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
Frank L. Curran
Grace O. Curran

Inventor.
John C. Swan.
by Sturtevant & Greeley
Attorneys

No. 683,352

Patented Sept. 24, 1901.

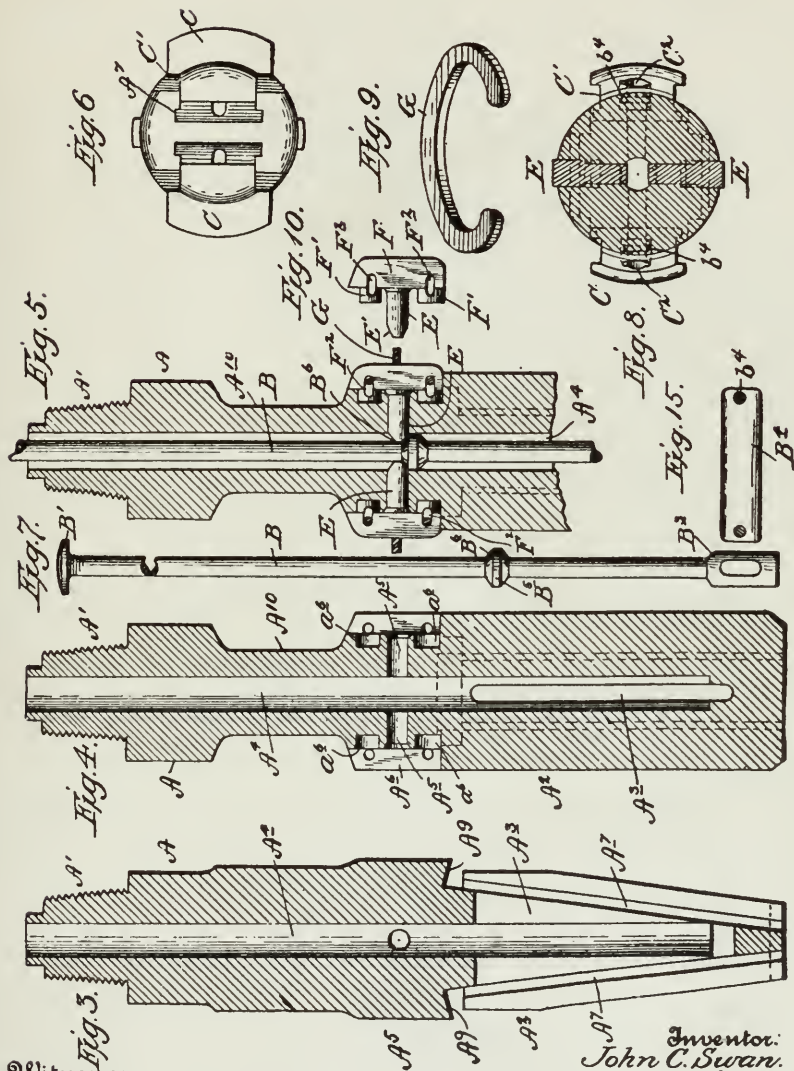
J. C. SWAN.

UNDERREAMER

(Application filed Dec. 10, 1900.)

(No Model.)

2 Sheets—Sheet 2.



Witnesses
 Frank L. Curand.
 Grace O. Brecken

Inventor:
 John C. Swan.
 by Sturtevant & Wreley
 Attorneys.

UNITED STATES PATENT OFFICE.

JOHN C. SWAN, OF MARIETTA, OHIO, ASSIGNOR TO SWAN MACHINE
& TOOL COMPANY, OF SAME PLACE.

UNDERREAMER.

SPECIFICATION forming part of Letters Patent No. 683,352, dated September 24, 1901.
Application filed December 10, 1900. Serial No. 39,404. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. SWAN, a citizen of the United States, residing at Marietta, in the county of Washington, State of Ohio, have invented certain new and useful Improvements in Underreamers, of which the following is a description, reference being had to the accompanying drawings and to the letters of reference marked thereon.

My invention relates to devices for reaming out or enlarging well-holes, and particularly to devices of such character intended for underreaming—that is, reaming out or enlarging the well-hole drilled below a casing in order to permit the casing to be lowered farther down; and my invention consists in the construction and combination of devices for this purpose hereinafter described.

In the drawings, Figure 1 is a perspective view, partly in section, showing the reaming-heads held in contracted position by means of the removable ring. Fig. 2 is a corresponding view showing the reaming-heads in expanded position ready for operation. Fig. 3 is a longitudinal sectional view of the reamer-body. Fig. 4 is a longitudinal sectional view of the reamer-body, taken on a plane at right angles to that on which Fig. 3 is taken. Fig. 5 is a longitudinal sectional view of the same plane as Fig. 4, showing the actuating-rod and trips in position. Fig. 6 is a cross-sectional view showing the reaming-heads in expanded position. Fig. 7 is a detail of the actuating-rod and spring. Fig. 8 is a cross-section on line 8 8 of Fig. 1. Fig. 9 is a detail of the removable ring. Fig. 10 is a detail view of one of the trips. Figs. 11, 12, 13, and 14 are detail views of the reaming-heads, and Fig. 15 is a detail of the pin which carries the reaming-heads.

In the drawings, A is the reamer-body, having at its upper end the screw coupling or pin A' and having its lower end A² wedge-shaped or tapered, as shown. Through the wedge-shaped or tapered portion is formed a slot A³, extending from a point near the lower end of this portion nearly to its upper end. A central bore A⁴ extends from the upper end of the reamer-body nearly to the lower end of the slot. In the sides or housing of the wedge-shaped or tapered portion A² ways

A⁷ are cut. These ways are made substantially dovetailed or wider at their inner ends, as shown at A⁸, in order to receive and retain corresponding extensions on the sides of the reaming-heads C. At the upper ends of the ways A⁷ are arranged abutments A⁹, preferably formed by cutting away the material of the reamer-body at an angle of about nineteen degrees to the horizontal. A short distance above these abutments radial holes A⁵ at right angles to the central bore A⁴ are formed. At the outer ends of these holes A⁵ are formed longitudinal recesses A⁶. Above these recesses is formed the usual tool-square A¹⁰.

In the central bore A⁴ of the reamer-body is arranged the spring-rod B. The rod extends above the upper end of the reamer-body and has a head B' at its upper end. Around the rod, between the head B' and the upper end of the reamer-body, is arranged a coiled spring B². The lower end of the rod B is also provided with a head B³. This head is slotted, as shown, and through it passes a flat pin B⁴. This pin extends radially outward in both directions through the slot A³ and carries at each end a reaming-head C, the reaming-heads being arranged to have free movement on the pin and the pin being arranged to be freely movable in the slot in the head B³. The reaming-heads C are provided with slots C², in which the ends of the pin B⁴ are received. These slots are countersunk at their outer ends, as shown at C³, to receive the heads of rivets b⁴, which are passed through the outer ends of the pin B⁴ and serve to prevent the removal of the reaming-heads from the pin. The outer faces of the reaming-heads are curved, preferably, on the arc of a circle of the diameter to which the well-hole is to be enlarged. The heads are wider at their lower ends than at their upper ends. Their rear portions are made narrower than their faces in order to fit within the ways A⁷ of the reamer-body and are substantially dovetailed in cross-section to fit and be retained by the ways. The upper ends of the reaming-heads are cut at an angle corresponding with the faces of the abutments A⁹, against which they rest when in expanded position, as hereinafter described. The reaming-heads are provided in their outer faces with

683,352

recesses c^4 for the insertion of hooks, by which they may be drawn downward into the position shown in Fig. 1.

Secured to the upper end of the reamer-body by its box D^2 , which screws onto the screw coupling or pin A' , is a spring-case D , having a central longitudinal bore D' of a diameter sufficient to receive the rod B with its spring B^2 . This bore D' extends upward a distance sufficient to permit the rod B to pass freely into it. The bore D' being closed at its upper end forms an air-tight chamber, which in operation will be so far filled with air under pressure as to exclude the water and sediment in which the tool ordinarily works from contact with the spring under ordinary pressures and to expel any water or sediment which may have entered the chamber under extraordinary pressures as the reamer is drawn upward. The spring B^2 , acting against the head B' , forces the rod B , and with it the pin B^4 , upward until the pin reaches the upper end of the slot A^3 . The pin will carry with it in its movement the reaming-heads C , and as these heads move upward they will be caused to move outward by their engagement with the central wedge and with the ways A^7 , cut in the housing or sides of the wedge-shaped or tapered lower portion A^2 of the reamer-body. At the limit of their upward movement the reaming-heads will rest with their upper angular ends in contact with the angular faces of the abutments A^9 . In this position the heads are ready for use. By drawing the reaming-heads downward they are caused to travel inward by reason of their engagement with the ways A^7 of the wedge-shaped or tapered portion A^2 of the reamer-body. The pin B^4 , and with it the spring-rod B , will be drawn downward with the heads until the pin reaches the lower end of the slot A^3 . In order to hold the reaming-heads in this position, I provide the rod B with an obstruction, preferably in the form of a shoulder B^5 , having a beveled upper face e . When the reaming-heads are drawn down as far as possible, this shoulder B^5 is in position to have its beveled face engaged with the tapered ends E' of pins E , which are inserted in the holes A^5 , above described. These pins are preferably integral with trips F , which are perfectly narrow strips of metal fitting the longitudinal recesses A^6 , above described. The angle of the beveled face B^6 of the shoulder B^5 and the taper E' of the pins E is such that if the pins are not positively held against the rod the spring B^2 will cause the bevel B^6 to force the pins outward sufficiently to permit the shoulder to pass the ends of the pins. The trips F are preferably provided on their inner faces with projections F' , which enter recesses a^6 in the reamer-body and are provided with slots F^2 , through which pass pins a^7 . By means of these pins and slots the movement of the trips is guided and at the same time limited. The projections F' and recesses a^6 also aid in guiding

the movement of the trips. It should be understood, however, that the form of the trips may be varied, it being essential only that the trips be capable when held at the limit of their inward movement of holding the pins E with their inner ends against the beveled faces of the shoulder B^5 , and thus preventing the upward movement of the spring-rod. 70 75

In order to insert the tool in the casing of the well, the reaming-heads will be drawn downward, as above described, to the limit of their movement in that direction. This will compress the spring B^2 and bring the shoulder B^5 in position to have its upper face B^6 engaged by the inner ends of the pins E . The pins E are then forced inward by pressure on the trips F , and the trips and pins are temporarily held in position by a removable ring G , made open at one side, as shown in Fig. 9, so that it can be readily slipped into place and removed at the tool-square formed on the reamer-body. The tool is then lowered into the casing. The reaming-heads will enter the casing freely and will pass through it without contact with its interior. The trips F will enter the casing and will be held from outward movement by contact with its interior. The ring G will not enter the casing; but as the tool enters the ring will be pushed upward until it reaches the tool-square, when it may be readily removed. The trips F are preferably rounded at their lower ends, so as to enter the casing readily and to pass any slight obstruction which may be met with as the tool is lowered through the casing. Their upper ends are preferably inclined and rounded, as shown, so as to enter the lower end of the casing when the tool is drawn upward through the casing. As the tool is lowered the reaming-heads, through the action of the interior walls of the casing holding the trips and pins from outward movement, and thus holding the spring-rod from upward movement, will be held out of contact with the interior of the casing, thus avoiding wear on the reaming-heads and possible injury to the casing. It will be understood that it is essential to the successful introduction of the reamer into the casing that the heads be held in this contracted position out of contact with the interior. As soon as the trips pass below the lower end of the casing, which, as will be understood, is elevated a short distance from the shoulder of the small hole to be reamed for the purpose of affording the space necessary for an effective stroke of the reamer, they will be forced outward by the action of the bevel B^6 on the ends of the pins E , the shoulder B^5 will pass the ends of the pins, and the reaming-heads through the action of the spring B^2 will be forced upward on the wedge-shaped or tapered portion A^2 until their upper ends rest against the abutments A^9 . They are then in position for operation. In operation this tool is made a part of the usual string of oil and Artesian well drilling tools. As the tool is raised and 120 125 130

allowed to fall, as in the usual operation of drilling, the lower outer edges of the reaming-heads will strike upon the shoulder left below the lower end of the casing and cut it away, thus enlarging or reaming out the hole already drilled to the size desired. The lower end of the portion A² of the reamer-body below the lower edges of the reaming-heads will enter the hole already drilled, and thus serve as a guide for the tool. If, as is often the case, the reaming-heads stick at the point of impact, the lift of the tool will free them by causing them to be drawn inward.

While it should be understood that sufficient metal is left in the tapered or wedge-shaped portion A² to give the necessary strength, the main effect of the impact of the reaming-heads on the material acted on by them is sustained by the abutments A⁹. The force of the impact tends to drive the lower ends of the reaming-heads inward and by a lever action to force the upper ends of these heads outward. This tendency to force the upper ends outward is overcome by forming the abutments A⁹ angular, as shown. The strain is thus taken off the upper portion of the ways A⁷.

In withdrawing the reamer as the tool is drawn upward the lower end of the casing coming in contact with the trips will force them inward, and as the tool is raised farther the end of the casing will cause the reaming-heads to move downward on the inclined portion A² until they are carried inward sufficiently to permit of their entrance within the casing. As the tool is raised through the casing the outer edges of the heads will necessarily be in contact with the interior of the casing.

The ways A⁷ are open at their lower ends, this construction permitting the reaming-heads to be readily removed and replaced, the pin B⁴ preventing the heads from dropping out in operation. The portion of the wedge or taper in which the ways A⁷ are formed is made of sufficient thickness to not only serve as a guide for the tool, as above described, but to also sustain the wear caused by the sidewise movement of the end of the tool in operation and the side blows of the reaming-heads, due to irregularities of the shoulder in hard rock.

It should be understood that the shoulder B⁵ may be of any preferred form, it being essential only that it be of sufficient size to have the beveled upper face B⁶ formed on it.

I prefer to make the reaming-heads in one piece of steel; but it should be understood that they may be made in one or more pieces and may be made part of steel and part of iron, as found most desirable. It should also be understood that I do not desire to be limited to the precise form or precise construction of the several parts of my device as shown and described, it being obvious that many changes may be made without depart-

ing from the essential features of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an underreamer, the combination of a reamer-body having a tapered or wedge-shaped portion, a reaming-head arranged to be movable on said tapered or wedge-shaped portion, means for automatically moving the reaming-head to the base or thick end of the tapered or wedge-shaped portion, and means arranged to contact with the interior of the casing for holding the reaming-head at the narrow end of the tapered or wedge-shaped portion during the passage of the tool through the casing; substantially as described.

2. In an underreamer, the combination of a reamer-body, having an oblique face formed thereon, an abutment at the upper end of the oblique face, retaining-ways along the oblique face, a reaming-head arranged to slide on the oblique face and to stop against the abutment, a spring above said abutment, connections between the spring and reaming-head for holding the reaming-head against the abutment and means arranged to contact with the interior of the casing for holding the reaming-head away from the abutment during the operation of lowering the tool through the casing; substantially as described.

3. In an underreamer, the combination of a reamer-body having a tapered or wedge-shaped portion, retaining-ways along the faces of the tapered or wedge-shaped portion, abutments at the upper ends of said faces, reaming-heads arranged to be movable on the tapered or wedge-shaped portion, a spring arranged to automatically move the reaming-heads into contact with said abutments and means arranged to contact with the walls of the well-casing for locking the spring against operation during the passage of the tool through the casing; substantially as described.

4. In an underreamer, the combination of a reamer-body, having a tapered or wedge-shaped lower portion, the lower end of which is adapted to enter the hole to be reamed or enlarged, abutments at the upper end of the tapered or wedge-shaped portion, reaming-heads movable on the tapered or wedge-shaped portion and arranged to stop against said abutments, yielding means for moving the reaming-heads to the wider end of the tapered or wedge-shaped portion into contact with said abutments, means arranged to contact with the interior of the casing for temporarily locking said yielding means against operation to hold the reaming-heads at the narrow end of the tapered or wedge-shaped portion, and means for retaining said locking means in operative position before the tool is inserted in the well-casing; substantially as described.

5. In an underreamer, the combination of a reamer-body, having a tapered or wedge-

shaped lower portion, reaming-heads movable in ways on said tapered or wedge-shaped portion, a rod within the reamer-body having near its lower end a pin extending through a slot in the reamer-body, and carrying the reaming-heads, a spring arranged to force the rod and with it the reaming-heads, upward into expanded position, pins carried by the reamer-body having their inner ends adapted to engage a shoulder carried by the rod to hold the rod from upward movement, and means for holding the pins in engagement with the shoulder on the rod during the passage of the tool through the well-casing; substantially as described.

6. In an underreamer, the combination of a reamer-body, having a tapered or wedge-shaped lower portion, reaming-heads movable in ways on said tapered or wedge-shaped portion, a rod within the reamer-body having near its lower end a pin extending through a slot in the reamer-body, and carrying the reaming-heads, a spring arranged to force the rod and with it the reaming-heads, upward into expanded position, pins carried by the reamer-body having their inner ends adapted to engage a shoulder carried by the rod to hold the rod from upward movement, and means adapted to contact with the interior of the casing for holding the pins in engagement with the shoulder on the rod during the passage of the tool through the well-casing; substantially as described.

7. In an underreamer, the combination of a reamer-body having a tapered or wedge-shaped portion provided with ways, reaming-heads carried in said ways, a pin connecting the reaming-heads and movable therein, a longitudinal rod having a shoulder thereon

within the reamer-body, through which the pin passes and is freely movable, means for moving the rod and means engaging the shoulder on the rod and arranged to contact with the interior of the casing for preventing the movement of the rod during the passage of the tool through the well-casing; substantially as described.

8. In an underreamer, the combination of a reamer-body having a tapered or wedge-shaped portion provided with ways, reaming-heads carried in said ways having their upper ends terminating at an oblique angle, and abutments formed on the reamer-body above the ways, having faces arranged at an oblique angle adapted to receive the upper ends of the reaming-heads and yielding means arranged above said reaming-heads for holding them against said abutments; substantially as described.

9. In an underreamer, the combination of a reamer-body having ways formed in its lower portion, reaming-heads carried in said ways, having their upper ends terminating at an oblique angle, and abutments formed on the reamer-body above the ways having their faces arranged at an oblique angle adapted to receive the upper ends of the reaming-heads whereby the force of the blow upon the abutments is directed inward toward the center of the reamer-body and yielding means for holding the reaming-heads against said abutments; substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN C. SWAN.

Witnesses:

GRAFTON L. MCGILL,
A. P. GREELEY.

**Defendant's Exhibit Certified Copy of File Wrapper
and Contents of O'Donnell & Willard U. S.
Patent No. 762,435.**

UNITED STATES OF AMERICA,
DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

To all to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true
copy from the Records of this Office of the File
Wrapper and Contents in the matter of the

Letters Patent of

Thomas A. O'Donnell & Arthur G. Willard,
Number 762,435, Granted June 14, 1904,
for

Improvement in Underreamers and Drills.

IN TESTIMONY WHEREOF, I have hereunto
set my hand and caused the seal of the Patent Office
to be affixed at the City of Washington, this 26th day
of November, in the year of our Lord one thousand
nine hundred and twelve and of the Independence of
the United States of America the one hundred and
thirty-seventh.

[Seal]

F. A. TENNANT,
Acting Commissioner of Patents.

[Endorsed]: U. S. Dist. Ct., So. Dist. Cal., So. Div.
In Equity—#1540. Union Tool Co. et al. vs. Wil-
son & Willard Mfg. Co. "Defendant's Exhibit Cer-
tified Copy of File Wrapper and Contents of O'Don-
nell-Willard U. S. Patent No. 762,435." Leo. Long-
ley, Special Examiner. Filed Apr. 16, 1913. Wm.
M. Van Dyke, Clerk. By Chas. N. Williams, Dep-
uty Clerk.

DIV. 38.

NUMBER (SERIES OF 1900). 1899 DIV. 25 38

739712

Div'n ~~XXV~~. 38

8

(EX'R'S BOOK). 223

PATENT No. 762435

Name—Thomas A. O'Donnell & Arthur G. Willard

of Los Angeles

County of

State of California,

Invention—Under-Reamer & Drill,

Division of App., No. 190
PARTS OF APPLICATION FILED.

ORIGINAL.	RENEWED.
Petition	Dec. 8, 1899, 190 , 190
Affidavit	" " " , 190 , 190
Specification	" " " , 190 , 190
Drawing—2 shts.	" " " , 190 , 190
Model or Specimen—None	, 190 , 190
First Fee Cash \$15, Dec. 8, 1899,	190 , 190
" " Cert.	, 190 , 190
Appl. filed complete Dec. 8, 1899,	190 , 190

Examined—A. P. Shaw, Ex. Dec. 7 , 1903 , 190

Countersigned—J. W. Babson , 190

12-8-1903 For Commissioner. For Commissioner.

Notice of Allowance Dec. 9 , 1903 , 190

Final Fee Cash \$20 May 23 , 1904 , 190

2 " " Cert. , 190 , 190

Patented June 14 , 1904

Associate Attorney Attorney—Townsend Bros.

Los Angeles,

California,

Name—Thos. A. O'Donnell &

3 Arthur G. Willard.

Patent No.

Serial Number—739712

Date of Patent

TOWNSEND BROS.
REGISTERED ATTORNEYS

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend Francis M. Townsend

Office: Potomac Block.

Los Angeles, California.

PETITION AND POWER OF ATTORNEY.

TO THE HON. COMMISSIONER OF PATENTS.

Your petitioners Thomas Arthur O'Donnell a citizen of the United States residing at Los Angeles in the County of Los Angeles, State of California and Arthur Gay Willard a citizen of the United States residing at Los Angeles in the county of Los Angeles and State of California, state that their respective post office addresses are 1553 Rockwood St and 1261 West 1st St. Los Angeles Cal and pray that letters patent may be granted to themselves for the ~~improvement in~~ Under Reamer and Drill set forth in the annexed specification, and they hereby appoint the firm of TOWNSEND BROS., the individual members of which firm are James R. Townsend, ~~Alfred I. Townsend~~ and Francis M. Townsend of Los Angeles, California their attorneys with full power of substitution and revocation to prosecute this application, to make alterations and amendments therein, to receive the patent and to transact all business in the PATENT OFFICE connected therewith.

THOS. A. O'DONNELL.

ARTHUR G. WILLARD.

SPECIFICATION:

To All Whom It may Concern

Be it known that We, Thomas Arthur O'Donnell and Arthur Gay Willard, citizens of the United States, residing at Los Angeles, in the County of Los Angeles and State of California, have invented a new and useful UNDER-REAMER AND DRILL, of which the following is a specification.

The object of our invention is to provide an under-reamer and drill which can be readily lowered through a casing smaller than the hole to be drilled and which, in operation, will expand below the casing and will ream out and drill a hole below the casing larger than the casing and which can invariably and without difficulty, be drawn up through the casing whenever it is so desired.

This under-reamer is adapted for use in all kinds of formation and in deep wells, such as oil wells and artesian wells. A difficulty to be avoided in the use of under-reamers is the liability of damaging the shoe or lower end of the casing when it is attempted to ream close to the casing. One object of our invention is to avoid any danger of such injury to the casing when reaming close to the casing; but at the same time providing for the positive locking of the jaws while they are below the casing. It is very important in the operation of under-reamers that the jaws shall be positively locked when they are working underneath the casing so that there shall be no looseness of parts and no liability of the jaws being crowded together or failing to cut.

Another object of our invention is to so construct

the under-reamer that there will be no openings through which dirt can get into the inside of the under-reamer to cause clogging or unnecessary wear.

Another object of our invention is to provide for the absolute automatic operation of the locking and unlocking device so that whenever the reamer passes below the casing it will immediately expand and positively lock and whenever it is drawn upward sufficiently to cause the jaws to engage the casing, the jaws will collapse and pass into the casing without any obstruction.

The accompanying drawings illustrate our invention.

Figure 1 is a fragmental view showing a side elevation of the lower end of our under-reamer as it appears in passing down inside the well-casing. In this view the side of the stock which is at the left in Fig. 4 is shown.

Fig. 2 is a like view showing the under-reamer in operation below the casing. In this view the side of the stock which is at the right in Fig. 4 is shown.

Fig. 3 is a vertical mid-section on line 3—3 Figs. 2, 4 and 5.

Fig. 4 is a vertical mid-section on line 4—4 Figs. 3 and 5.

Fig. 5 is a sectional plan on a plane cutting through the locking-bolt. The plane of this section is indicated by the line 5—5, cutting through the dotted position shown in Figs. 3 and 4.

Fig. 6 is a fragmental perspective detail view showing the interior parts which are detachable from the

stock. A fragment of the stock is shown in vertical mid-section.

Fig. 7 is a like fragmental perspective view illustrating the interior parts in further detail.

1 indicates the stock provided with an upwardly tapering frusto conical socket 2 in its lower end, which socket is practically formed into two tapering sockets by a vertically slotted wedge shape partition 3 extending across the socket 2 of the stock and fitted at its opposite edges to the socket and provided with a transverse slot 4. The upper end of the partition 3 is screw-threaded as at 5 and screwed into the stock. 6 indicates a way through the upper end of the partition leading from the slot 4 into a spring chamber 7 provided in the stock above the partition. 8 indicates a cross-head in the slot and provided with a stem 9 extending through the way 6 into the spring chamber. 10 indicates the spring in the spring chamber for normally holding the stem up. 11 indicates nuts on the upper end of the stem to rest upon the spring. 12 indicates a jaw member provided with a tapering shank 13 to fit in one of the tapering shank-sockets formed between the partition 3 and the wall of the tapering socket 2 in the end of the stock. The shank 13 is provided with a cross-head-socket 14 in the extended plane of the slot 4 of the partition. The jaw-member is provided with a shoulder 15 to fit against the lower end of the stock when the shank is fully seated in the tapering socket. 12' indicates a like jaw-member provided with the shank 13', cross-head-socket 14' and shoulder 15'; and said jaw-member 12' is arranged with its shank in the other

socket formed therefor between the partition 3 and the wall of the tapering socket 2. The cross-head 8 is arranged to play in the slot 4 and its opposite ends are inserted in the cross-head-sockets 14 14' so that the two jaw-members are carried by the spring 10 through the medium of the stem and cross-head. 16 indicates a spring-pressed bolt normally extending across the slot 4 in the path of the cross-head 8 to lock the cross-head against lowering. In Fig. 3 the normal locking position of this bolt is indicated in dotted lines at the lower end of the view. The outer end of the bolt is provided at its upper side with a bevelled face 17 which is normally chambered in a portion of the bolt-hole 18 which extends through the partition and through the stock, being closed at one end by a screw-plug 19. 20 indicates a spring in the bolt-hole to normally hold the bolt 16 normally inserted across the slot 4 with its bevelled portion 17 fully beyond the slot. 21 indicates a bolt-retracting pin mounted in the bolt-hole and normally projecting from the side of the stock to be engaged and thrown by the well-casing 22 to bring the bolt 16 into position shown in solid lines in Fig. 4 with the bevelled face 17 of the bolt in the path of the cross-head 8. The cross-head 8 has a bevelled face 23 to engage the bevelled face 17 of the bolt when the bolt is in its retracted position shown in solid lines in Fig. 4.

The spring 10 is of sufficient strength to normally hold the jaws 12 12' in their updrawn position with their shanks fully seated in the socket therefor. The bolt-hole 18 is larger at the end which is closed with

the plug 19 than at the opposite end; and shoulders 24 and 25 are provided to respectively prevent the bolt and the bolt-retracting pin from being thrown too far by the force of the bolt-spring 20. Preferably the bolt 16 is provided with a chamber 26 to seat one end of the spring 20, and the spring-holding plug 19 is provided with a like chamber 27 to seat the other end of the spring 20.

For convenience in assembling the parts the cross-head-stem 9 is made of two parts, one of which, *a*, is integral with the cross-head and the other, *b*, is screwed to the part *a*. The part *a* of the stem, together with the cross-head, are of less length than the slot 4 and said stem is of greater length than the way 6 so that the part *a* and cross-head 8 can be inserted into the slot and the section *a* then pushed up through the way 6; then the section *b* of the stem 8 is screwed onto the section *a*; after which the spring is placed in position and the nuts 11 screwed down into place to give the appropriate tension to the spring which rests upon the upper end of the partition 3. Then the jaws 12 12' are placed against the sides of the partition with their sockets 14 14' caught over the ends of the cross-head 8, and the parts thus assembled are inserted into the conical socket 2 and turned to screw the screw-threaded upper end of the partition into the screw-threaded part therefor in the stock. 28 indicates a screw inserted through the stock and screwed into the partition to prevent the partition from unscrewing.

After the parts have thus been assembled the bolt

Oct. 30,
1900
and guideway

retracting-pin 21 is inserted into the bolt-hole A 18. Then the bolt 16 is inserted into the bolt-hole 18, and the spring 20 is brought into place and the plug 19 screwed home. The tool is then in condition for operation.

In practical operation in order to start the tool down into the well through the casing 22, the workman will first push the bolt-retracting pin 21 in into the position indicated in solid lines in Fig. 4, and then will draw the jaws 12 12' down into the position indicated in Fig. 1. Then the tool will be let down into and allowed to pass through the casing. It is to be observed in Figs. 1 and 4 that the jaws are rounded as at 29 so that the cutting edge of the jaws are in-turned when the jaws are in their down-drawn position, so that the cutting edges will not touch the casing during the decent of the tool.

When the tool has passed beyond the shoe 22' of the casing, the spring 10 draws the cross-head up, thus drawing the bits up into their socket in the stock, the jaws engaging the walls of the well will be held thereby sufficiently so that the downward stroke of the stock assists the action of the spring to seat the jaw-shanks firmly in their sockets, thus bringing the shoulders 15 15' to fit firmly against the end of the stock. The spring 20 throws the bolt 16 and the pin 21 so that the bevelled face 17 of the bolt is chambered in the partition and the cross-head is thus effectually locked against drawing out of the stock on the up-stroke of the stock.

Whenever the tool is draws upward so far that the pin 21 is again forced in by the shoe 22' of the casing,

the bolt is thrown into its unlocking position so that when the shoulders 15 15' of the jaws engage with the shoe 22', the cross-head is free to slip in the stock, thus to allow the stock to be drawn up while the jaws collapse into the position indicated in solid lines in Fig. 1 and in dotted lines in the upper position in Fig. 3. The tool can therefore be readily drawn out through the casing and can be lowered and raised at pleasure and whenever it is below the casing it is ready for effective operation as before described.

The partition 3 is flat faced and holds the jaws spread apart when the shanks are fully seated in the shank-sockets.

The ends of the cross-head have sufficient play in their sockets to allow the jaws to swing freely toward each other as the shanks withdraw from the shank-sockets.

The bolt and its retracting-pin are to be located as close as possible to the shoulders and the cutting-edges of the jaws so that the jaws may become locked as soon as possible after passing below the lower end of the casing and will work in locked position very close to the bottom of the casing, and yet will always be fully unlocked before the shoulders can injure the bottom of the casing on an up-stroke.

What we claim and desire to secure by letters-patent of the United States is:

1. An under-reamer comprising a stock provided with two tapering sockets in its lower end, a vertically slotted wedge-shape partition between the sockets, and having bolt-holes opening from the slot axially in line with each other below the top of such sockets, such stock being also provided with a spring-

chamber above the partition; a jaw-member provided with a tapering shank to fit in one of said sockets, and also provided with a shoulder to fit against the lower end of the stock when the tapering shank is seated in its socket, said shank being provided with a cross-head socket in the extended plane of said slot; a like jaw-member having its shank seated in the other socket of the stock; a cross-head to play in the slot and having its opposite ends seated in the sockets of the shanks, respectively, and having a stem extending up into the spring-chamber; a spring in said chamber for normally holding up the stem, cross-head and jaws; a spring-pressed bolt normally extending across the slot in the path of the cross-head to lock the cross-head against lowering, said bolt having at the upper side of its end a bevelled portion normally chambered in the partition; a spring for normally holding the bolt in its locking position; and a bolt-retracting pin mounted in the bolt-hole and normally projecting from the side of the stock to be thrown by the well-casing to bring the bolt into position with the bevelled portion of the bolt in the path of the cross-head.

2. The combination of a stock provided with a tapering socket in its lower end and with a spring-chamber above said socket and with a screw-threaded portion between said spring-chamber and said socket; a wedge-shape partition fitted in the socket of the stock and provided with a transverse slot and screwed into the stock and provided with a way leading from the slot through the upper end of the partition; a cross-head in the slot and provided with a stem extending the way into the spring-chamber; a spring in

the spring-chamber for normally holding the stem up; two jaw-members carried by the cross-head on the opposite sides of the partition and each provided with a tapering shank to fit the stock-socket on opposite sides of the partition and also provided with a shoulder to engage the lower end of the stock when the shanks are seated in their sockets in the stock; a spring-pressed bolt to play across the slot in the partition and provided with a bevelled portion at the upper side and outer end; and a bolt-retracting pin mounted in the stock and normally projecting from the side of the stock to be thrown by the well-casing to bring the bolt into position with the bevelled portion of the bolt in the path of the cross head.

3. In an under-reamer, the combination with a ^{having a transverse guideway} jaw-carrying head Λ of a locking-bolt for the head ^{in said guideway} Λ a spring for holding the bolt in locking position; ^{sliding in said guideway coaxial of the bolt} and a bolt-retracting pin Λ to engage the well-casing to retract the bolt.

4. An under-reamer-stock provided with a socket in its lower end and a partition fastened in the socket to form two shank-seating sockets to seat the shanks of two jaws on opposite sides of said partition.

5. An under-reamer comprising a stock, the lower end of which has two upwardly tapering shank-seating sockets with a flat faced downwardly tapering partition between said shank-seating sockets; jaws respectively provided with shanks to fit in said sockets; and means for yieldingly holding the jaws in place with their shanks seated in said sockets.

IN TESTIMONY WHEREOF we have signed our names to this specification in the presence of two subscribing witnesses, at Los Angeles, California, this 28th day of November, 1899.

Inventors:

THOS. A. O'DONNELL.

ARTHUR G. WILLARD.

Witnesses:

JAMES R. TOWNSEND.

FRANCIS M. TOWNSEND.

OATH.

STATE OF CALIFORNIA,
COUNTY OF LOS ANGELES,—ss.

Thomas Arthur O'Donnell and Arthur Gay Willard the above-named petitioners, being duly sworn (or affirmed) depose and say that they verily believe themselves to be the original, first and joint inventors or discoverers of the ~~improvement in~~ Under-Reamer and Drill described and claimed in the annexed specification; that they do not know and do not believe that the same was ever known or used before their invention or discovery thereof; or patented or described in any printed publication in any country before their invention or discovery thereof or more than two years prior to this application; or in public use or on sale in the United States for more than two years prior to this application, and that no application for patent on said improvement has been filed

Legal representatives or assigns

by them or their ~~representatives~~ in any foreign country, except as follows:

And said Thomas Arthur O'Donnell states that he

is a citizen of the United States and resident of Los Angeles in the County of Los Angeles and State of California.

And said Arthur Gay Willard states that he is a citizen of the United States and resident of Los Angeles in the County of Los Angeles and State of California.

And said — states that he is a citizen of — and resident of — in the County of — and State of —. And said — states that he is a citizen of — and resident of — in the County of — and State of —.

THOS. A. O'DONNELL.

ARTHUR G. WILLARD.

Sworn to and subscribed before me this 28th day of November, 1899.

[Seal]

L. C. BECKER,

Notary Public in and for the County of Los Angeles,
State of California.

Serial No. 739,712. Paper No. 1½. APPLICATION. Filed Dec. 8, 1899. O'Donnell & Willard.

U. S. PATENT OFFICE. DEC. 8, 1899.
CHIEF CLERK.

Paper No. —.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. — Room No. 243.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.

Washington, D. C., Jan. 6, 1900.

MAILED, “ “ “

O'Donnell & Willard,
Care Townsend Bros.,
Los Angeles, California.

Please find below a communication from the
EXAMINER in charge of your application.

#739,712, filed Dec. 8, 1899, for Under-Reamer and
Drill.

C. H. DUELL,
Commissioner of Patents.

Claims 1 and 2 will be allowed, as at present advised.

Claim 3 is rejected upon reference to 414,411, Herberg, Nov. 5th, 1889—Artesian & Oil Wells; Reamers. See, for a further view of the prior art, 294,302, Allen, Feb. 26th, 1884—same sub-class, and 634,941, Hall, Oct. 17th, 1899—Reamers.

LEWIS B. WYNNE,
Examiner, Division.

XXV.

A. McN.

Serial No. 739,712. Paper No. 1. Exrs. Letter Rejection. Dated Jan. 6, 1900. O'Donnell and Willard.

ROOM 243.

DIV. 25.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend, ~~Alfred I. Townsend~~, Francis
M. Townsend.

Office 9 Downey Block.

Los Angeles, Cal., Oct. 3, 1900. 189

O'Donnell & Willard,

Under Reamer and Drill,

Filed Dec. 8, 1899, S. No. 739,712.

18 No.

Commissioner of Patents,

Sir: Examiner's letter of Jan. 6, 1900, and the patents cited have been considered.

We request reconsideration of claim 3, for the reason that the patent does not show any bolt-retracting pin for retracting the bolt 16.

In order to make this claim clearer we amend the
specification as follows:

Page 5, line 4, after "bolt-hole" insert and guide-
way.

Claim 3, line 2, before the comma insert having a

128 *Wilson & Willard Manufacturing Company*
transverse guideway. Before the semicolon insert
in said guideway.

Line 3, after "pin" insert sliding in said guideway
coaxial of the bolt.

The application now appears to be in condition
for issue.

Very respectfully,
TOWNSEND BROS.
Attorneys for O'Donnell & Willard.

JRT.

W.

Serial No. 739,712, Paper No. 2. Amendment.
Filed Oct. 30, 1900. O'Donnell and Willard.

U. S. Patent Office. Oct. 29, 1900. Chief Clerk.
United States Oct. 30, 1900. Patent Office. Patent
Office Oct. 31, 1900. Division XXV.

Paper No. —.

All communications respecting this application
should give the serial number, date of filing, and
title of invention.

Div. — Room No. 243.

Address only

"The Commissioner of Patents,
Washington, D. C."

DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.

Washington, D. C., Nov. 26, 1900.

MAILED

" " "

O'Donnell & Willard,
Care Townsend Bros.,
Los Angeles, California.

Please find below a communication from the EXAMINER in charge of your application.

#739,712, filed Dec. 8, 1899, for Under-Reamer and Drill.

C. H. DUELL,
Commissioner of Patents.

Case as amended Oct. 30th, 1900, considered.

The 3d claim is undoubtedly devoid of patentable novelty in view of Herberg, before cited, and it is therefore again rejected thereon. Said claim is also anticipated in 381,124, Gail, April 17th, 1888—Artesian & Oil Wells; Reamers.

The 4th claim is rejected in view of 634,941, Hall, Oct. 17th, 1899; or British patent 10,225, of 1896, to Tarbini—same subclass. See, also, 48,388, Fisher, June 27th, 1865, and 111,265, Shoemaker, Jan. 24th, 1871—Stone Working; Drills (D).

The 1st and 2d claims have been allowed, and the 5th probably will be.

A. McNAUGHT,
Act'g Examiner, Div. XXV.

Serial No. 739,712, Paper No. 3. Exrs. Letter. Rejn. Dated Nov. 26, 1900. O'Donnell and Willard.

130 *Wilson & Willard Manufacturing Company*

ROOM 243.

DIV, 25.

MAILED

NOV. 14, 1901.

Townsend Bros.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

O'Donnell & Willard,

Under Reamer and Drill,

Filed Dec. 8, 1899, S. No. 739,712.

Dated — No. —.

Los Angeles, Cal. Nov. 14, 1901, 190

Commissioner of Patents,

Sir: Examiner's letter of Nov. 26, 1900, and the patents cited have been considered.

We amend as follows:

Re-write claims 3 and 4 to read as follows:

A "3. In an under-reamer, the combination with a jaw-carrying head having a transverse guideway, of a locking-bolt for said head arranged in said guideway; a pin sliding in said guideway to retract the bolt to unlock the head; a stop for said pin being provided in the guideway; and a spring to normally press the bolt toward the stop and into locking position, and to project the pin from the head to be returned by contact with the casing.

per C 4. An under-reamer-stock provided with a socket downwardly tapering partition rigidly fixed in its lower end; a slotted, A ~~partition fastened~~ in the socket to form two shank-seating sockets to seat the shanks of two jaws on opposite sides of said partition; a jaw on each side of said partition; A and a jaw-carrying head moving in the slot of said partition."

per D

Insert

B

Dec. 28/01.

It is thought the foregoing amendment is self-explanatory and that the application may now be passed for issue.

Very respectfully,

TOWNSEND BROS.

Attorneys for O'Donnell & Willard.

JRT—W.

Serial No. 739,712, Paper No. 4. Amendment A.
Filed Nov. 19, 1901. O'Donnell and Willard.

Patent Office. Nov. 21, 1901. Division XXV.
Mail Room. Nov. 19, 1901. U. S. Patent Office.

A. B. S.

Paper No. —.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div.—, Room No. 243.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.

Washington, D. C., Dec. 3, 1901.

MAILED

“ “ “

O'Donnell & Willard,
c/o Townsend Bros.,
Los Angeles, California.

Please find below a communication from the
EXAMINER in charge of your application.

#739,712, filed Dec. 8, 1899, for Under-Reamer and Drill.

F. I. ALLEN,
Commissioner of Patents.

Case considered as amended Nov. 19, 1901.

The 3d claim will be allowed, as at present advised.

The 4th claim is destitute of patentable novelty in view of 460,444, McGregory, Sept. 29, 1891—Artesian & Oil Wells; Reamers, and it is therefore rejected. See, also, 434, 241, Bowe, Aug. 12, 1890—same sub-class.

The remaining claims stand allowed.

LEWIS B. WYNNE,
Examiner,

A. McN. Division XXV.

Serial No. 739,712, Paper No. 5. Exrs. Letter Rejection. Dated Dec. 3, 1901. O'Donnell and Willard.

ROOM 243.

DIV. 25.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

O'Donnell & Willard,
Under-Reamer and Drill,
Filed Dec. 8, 1899, S. No. 739,712.
Dated — No. —.

Los Angeles, Cal., Dec. 23, 1901. 190
Commissioner of Patents,

Sir: Examiner's letter of Dec. 3, 1901, and the patents referred to have been considered.

We request reconsideration and allowance of claim 4, for the reason that McGregory does not show the socket in the stock, and Bowe does not show any partition and the two patents taken together do not show applicants' idea of means set forth in the claim.

Add the following claim:—

“6. An under-reamer comprising a stock provided with a socket in its lower end; a ^{stationary} Λ slotted partition ^{and extending from side to side thereof} fastened in the socket Λ to form two shank-seating-sockets to seat the shanks of two jaws on opposite sides of said partition; a jaw-carrying head moving in the slot of said partition; means for yieldingly holding said head up; and jaws carried by said head and having shanks seated in said sockets.”

The foregoing claim appears to be so clearly allowable over the patents referred to that further remark is deemed unnecessary.

We trust the application may now be passed for issue.

Very respectfully,

TOWNSEND BROS.,

Attorneys for O'Donnell and Willard.

JRT—W.

Serial No. 739,712, Paper No. 6. Amendment B.
Filed Dec. 28, 1901. O'Donnell and Willard.

Patent Office. Dec. 31, 1901. Division XXV.
Mail Room. Dec. 28, 1901. U. S. Patent Office.

M. E. C.

Paper No. —.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. —, Room No. 243.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.

Washington, D. C., Feb. 19, 1902.

Mailed “ “ “

T. A. O'Donnell, and A. G. Willard,
Care Townsend Bros.,
Los Angeles, California.

Please find below a communication from the EXAMINER in charge of your application.

#739,712, filed Dec. 8, 1899, for Under-Reamer and Drill.

F. I. ALLEN,
Commissioner of Patents.

Case considered as amended Dec. 28, 1901.

The 4th claim is again rejected as destitute of patentable novelty in view of either *Bowe* (434,241) or *McGregory* (460,444) before cited. Said claim is also anticipated in 679,384, *Kellerman*, July 30, 1901, *Artesian and Oil Wells, Reamers*, application filed July 30, 1899.

The 5th and 6th fail to define patentable novelty

in view of the above-cited references, and they are accordingly rejected.

The remaining claims stand allowed.

LEWIS B. WYNNE,

Examiner.

A McN.

Serial No. 739,712. Paper No. 7. Exrs. Letter
Rejn. Dated Feb. 19, 1902. O'Donnell and Willard.

ROOM 243.

739,712, Paper No. 8.

DIV. 90.

Amdt. C.

MAILED

DEC. 9, 1902.

Townsend Bros.

TOWNSEND BROS.

Registered Attorneys.

430-431-432-433 BRADBURY BLOCK,

304-306 S. Broadway.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

T. A. O'Donnell and A. G. Willard,

Under-Reamer and Drill.

Filed Dec. 8, 1899. S. No. 739,712.

Dated No.

Los Angeles, Cal., Dec. 9, 1902. 190

Hon. Commissioner of Patents,

Sir: Examiner's letter of Feb. 19, 1902, and the
patents referred to have been considered.

We amend as follows:—

Claim 4, line 2, insert a comma after "slotted" and
change "partition fastened" to—downwardly taper-
ing partition rigidly fixed—.

Rewrite claim 5 as follows:—

C¹

—5. An under-reamer comprising a stock, the lower end of which has two upwardly tapering shank-seating sockets with a flat faced downwardly tapering partition rigidly fixed between said shank-seating sockets; a vertically movable cross-head in the slot of the partition; shouldered jaws carried by said cross-head; and an upwardly tapering shank for each socket.—

Claim 6, line 2, before “slotted” insert—stationary—. Line 3, after “socket” insert—and extending from side to side thereof—.

Add the following claim:

C²

—7. An under-reamer comprising a stock provided with a plurality of tapering sockets in its lower end; a stationary, vertically slotted partition separating the sockets; a jaw-member; a tapering shank for said jaw-member, said shank being provided with a cross-head socket in the extended plane of said slot; a like jaw-member having its shank seated in an opposite socket of the stock; a cross-head to play in the slot and having opposite ends seated in the socket of the shanks, respectively, and having an upwardly extending stem, means for yieldingly holding up the stem cross-head and jaws; a spring-pressed bolt normally extending across the slot in the path of the cross-head to lock the cross-head against lowering, said bolt having at its upper end a beveled portion; a spring for normally holding the

bolt in its locking position; and means adapted to be engaged by the well-casing to bring the bolt into position with the beveled portion thereof in the path of the cross-head.—

We believe the foregoing amendment places the case in condition meriting favorable action.

Very respectfully,

TOWNSEND BROS.,

Attys. for O'Donnell & Willard.

JRT.—A.

ALBERT H. MERRILL.

Mail Room. Dec. 15, 1902. U. S. Patent Office.
U. S. Patent Office. Dec. 16, 1902. Division XXV.
U. S. Patent Office. Dec. 16, 1902. Division 38.

LC.

Paper No. 9.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. —, Room No. 222.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR.
UNITED STATES PATENT OFFICE.

Washington, D. C., January 3, 1903.

Mailed “ “ “

O'Donnell & Willard,

Care Townsend Bros.,

Bradbury Block,

Los Angeles, California.

Please find below a communication from the EXAMINER in charge of your application for "Under Reamer and Drill," filed December 8, 1899, Serial No. 739,712.

F. I. ALLEN,
Commissioner of Patents.

In response to the communication filed December 15, 1902:

Claim 4 is rejected as being incomplete. The claim should include the jaws. As they are now directly referred to, they should be positively included to make an operative device.

Claims 1, 2, 3, 5, 6, and 7, are considered allowable.

A. P. SHAW, Ex.

MEP.

Paper #10.

MAIL ROOM.

739,712, Paper No. 10.

NOV. 9, 1903.

Amdt. D.

U. S. PATENT OFFICE.

MAILED

NOV. 3, 1903.

Townsend Bros.

U. S. Patent Office.

ROOM 222.

NOV. 9, 1903.

DIV. 38.

DIVISION 38.

TOWNSEND BROS.

Registered Attorneys.

430-431-432-433 Bradbury Block,

304-306 S. Broadway.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

O'Donnell & Willard,

Under-Reamer and Drill.

Filed Dec. 8, 1899. S. No. 739,712.

Dated No.

Los Angeles, Cal., Nov. 3, 1903. 190

Hon. Commissioner of Patents,

Sir: In response to Examiner's letter dated Jan. 3, 1903, we amend as follows:—

Claim 4, line 4, before "and" insert—a jaw on each side of said *partion*;—

Final allowance is now believed to be in order.

Very respectfully,

TOWNSEND BROS.,

Attorneys for O'Donnell et al.

FMT.

A. H. MERRILL.

M.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend

Francis M. Townsend

~~Alfred I. Townsend~~

430-431-432-433 (Opposite City Hall) Broadway,

Bradbury Block, 304-306 S. Broadway.

\$20— RECEIVED

ck MAY 23, 1904. Z.

CHIEF CLERK. U. S. PATENT OFFICE.

Thomas O'Donnell & A. G. Willard,

Under Reamers.

Filed Dec. 8, 1899. S. No. 739,712.

Allowed Dec. 9, 1903. No.

140 *Wilson & Willard Manufacturing Company*

Los Angeles, Cal., May 17, 1904. 189
Commissioner of Patents.

Sir: We herewith hand you ^{in our check} U. S. ~~Certificate of~~
~~Deposit~~ for \$20.00 final Government Fee in the mat-
ter of the above-mentioned application. Please
issue the patent as per record.

Very respectfully,
TOWNSEND BROS.

CERTIFICATE.

AMOUNT RECEIVED.

\$15.00.

CHIEF CLERK.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend Francis M. Townsend

Alfred I. Townsend

OFFICE 9 DOWNEY BLOCK

321-322-323-324, Potomac Block (Opposite City
Hall), Broadway.

Thomas Arthur O'Donnell & Arthur Gay Willard,
Under-Reamer and Drill.

Application sworn Nov. 28, 1899.

Los Angeles, Cal. Dec. 2, 1899. 189
Commissioner of Patents.

Sir: We herewith enclose Petition and Power of
Attorney, Specification, Oath, and 2 sheets of Draw-
ings in the matter of the above-mentioned Applica-

tion for Patent. Also U. S. Certificate of Deposit covering \$15.00 Filing Fee.

Very respectfully,
TOWNSEND BROS,

JRT. per H. R.
W.

U. S. PATENT OFFICE. DEC. 8, 1899. CHIEF
CLERK.

ivision.

ons should be addressed to
mmissioner of Patents,
Washington, D. C."

Serial No. 739,712.

DEPARTMENT OF THE INTERIOR.

U. S. PATENT OFFICE,

Washington, D. C., Dec. 9, 1903.

Thomas A. O'Donnell and

Arthur G. Willard,

c/o Townsend Bros.,

Los Angeles, Cal.

Sir: Your APPLICATION for a patent for an
IMPROVEMENT IN

Under-Reamers and Drills,

Filed Dec. 8, 1899, has been examined and AL-
LOWED.

The final fee, Twenty Dollars, must be paid, and
the Letters Patent bear date as of a day not later
than SIX MONTHS from the time of this present
notice of allowance.


patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The Office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least **TWENTY DAYS** prior to the conclusion of the six months allowed them by law. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, **DISTINCTLY AND PLAINLY WRITTEN**, the name of the **INVENTOR** and **TITLE OF INVENTION AS ABOVE GIVEN**, **DATE OF ALLOWANCE** (which is the date of this circular), **DATE OF FILING**, and, if assigned, the **NAMES OF THE ASSIGNEES**.


If you desire to have the patent issue to **ASSIGNEES**, an assignment containing a **REQUEST** to that effect, together with the **FEE** for recording the same, must be filed in this Office on or before the date of payment of final fee.


After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of 5 cents each. The money should accompany the order. Postage stamps will not be received.

Respectfully,
F. I. ALLEN,
Commissioner of Patents.

 After allowance, and prior to payment of the final fee, applicants should carefully scrutinize the description to see that their statements and language are correct, as mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent.

[Written across face and in margin:]

 IN REMITTING THE FINAL FEE GIVE THE SERIAL NUMBER AT THE HEAD OF THIS NOTICE.

 If payment is made by check or draft, the credit allowed is subject to the collection of the same.

Issue and Gazette Division. Serial No. 739,712

All communications should be addressed to

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,

Washington, D. C., May 23, 1904.

Thomas A. O'Donnell & Arthur G. Willard,

C/o Townsend Bros.,
Los Angeles, Cal.

Sir: Your application for a patent for an IMPROVEMENT IN

Underreamers and Drills.

filed Dec. 8, 1899, ~~190~~, has been examined and again ALLOWED.

The final fee, TWENTY DOLLARS, in the above-entitled case was received May 23, 1904.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

No. 762,435.

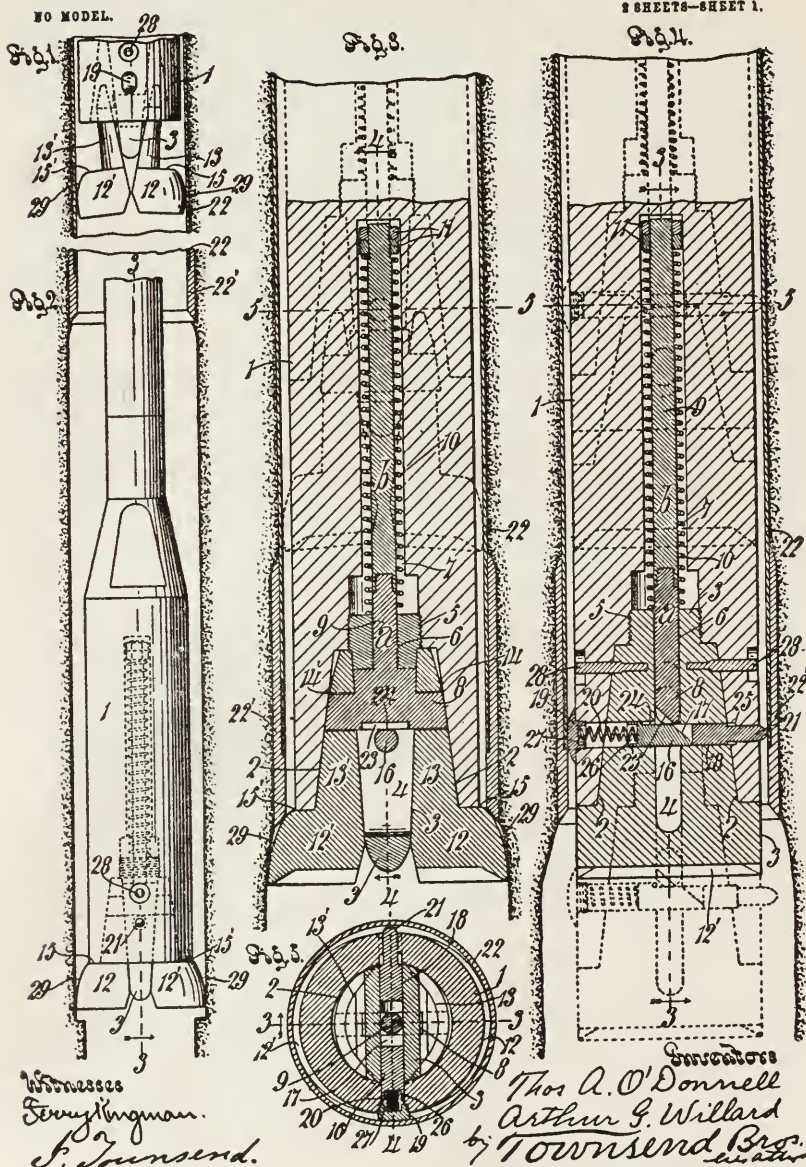
PATENTED JUNE 14, 1904

T. A. O'DONNELL & A. G. WILLARD.

UNDERREAMER AND DRILL.

APPLICATION FILED DEC. 8, 1899.

2 SHEETS—SHEET 1.



Witnesses
 Henry Kingman.
 J. Townsend.

Inventors
 Thos. A. O'Donnell
 Arthur G. Willard
 by Townsend Bros.
 Attorneys

No. 762,435.

PATENTED JUNE 14, 1904

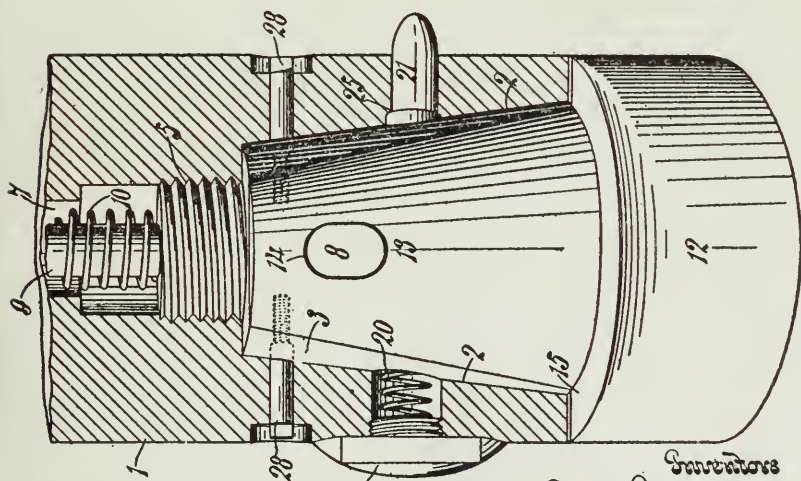
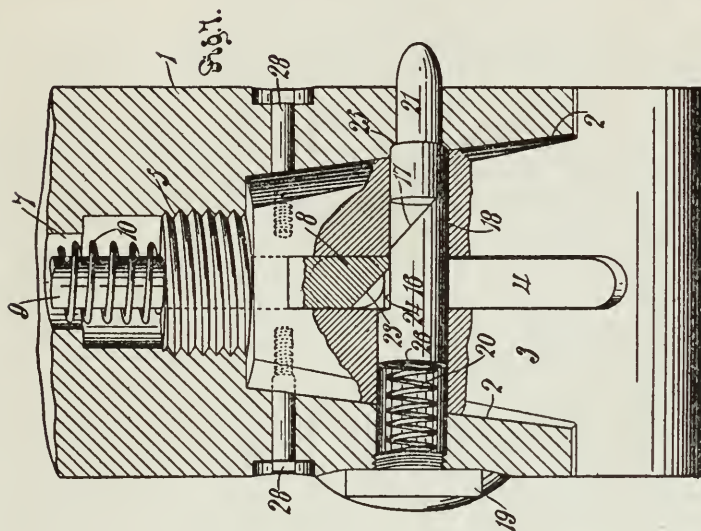
T. A. O'DONNELL & A. G. WILLARD.

UNDERREAMER AND DRILL.

APPLICATION FILED DEC 8 1899

NO MODEL.

2 SHEETS—SHEET 2



Witnesses
 George Ingman
 J. Townsend.

Inventors
 Thos. A. O'Donnell
 Arthur G. Willard
 by Townsend Bros.
 Attys.

UNITED STATES PATENT OFFICE.

THOMAS A. O'DONNELL AND ARTHUR G. WILLARD, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER AND DRILL.

SPECIFICATION forming part of Letters Patent No. 762,435, dated June 14, 1904.

Application filed December 8, 1899. Serial No. 739,712. (No model.)

To all whom it may concern:

Be it known that we, THOMAS ARTHUR O'DONNELL and ARTHUR GAY WILLARD, citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, having invented a new and useful Underreamer and Drill, of which the following is a specification.

The object of our invention is to provide an underreamer and drill which can be readily lowered through a casing smaller than the hole to be drilled and which in operation will expand below the casing and will ream out and drill a hole below the casing larger than the casing and which can invariably and without difficulty be drawn up through the casing whenever it is so desired. This underreamer is adapted for use in all kinds of formation and in deep wells, such as oil-wells and Artesian wells. A difficulty to be avoided in the use of underreamers is the liability of damaging the shoe or lower end of the casing when it is attempted to ream close to the casing.

One object of our invention is to avoid any danger of such injury to the casing when reaming close to the casing, but at the same time providing for the positive locking of the jaws while they are below the casing. It is very important in the operation of underreamers that the jaws shall be positively locked when they are working underneath the casing, so that there shall be no looseness of parts and no liability of the jaws being crowded together or failing to cut.

Another object of our invention is to so construct the underreamer that there will be no openings through which dirt can get into the inside of the underreamer to cause clogging or unnecessary wear.

Another object of our invention is to provide for the absolute automatic operation of the locking and unlocking device, so that whenever the reamer passes below the casing it will immediately expand and positively lock, and whenever it is drawn upward sufficiently to cause the jaws to engage the casing the jaws will collapse and pass into the casing without any obstruction.

The accompanying drawings illustrate our invention.

Figure 1 is a fragmental view showing a side elevation of the lower end of our underreamer as it appears in passing down inside the well-casing. In this view the side of the stock which is at the left in Fig. 4 is shown. Fig. 2 is a like view showing the underreamer in operation below the casing. In this view the side of the stock which is at the right in Fig. 4 is shown. Fig. 3 is a vertical mid-section on line 3 3, Figs. 2, 4, and 5. Fig. 4 is a vertical mid-section on line 4 4, Figs. 3 and 5. Fig. 5 is a sectional plan on a plane cutting through the locking-bolt. The plane of this section is indicated by the line 5 5, cutting through the dotted position shown in Figs. 3 and 4. Fig. 6 is a fragmental perspective detail view showing the interior parts, which are detachable from the stock. A fragment of the stock is shown in vertical mid-section. Fig. 7 is a like fragmental perspective view illustrating the interior parts in further detail.

1 indicates the stock, provided with an upwardly-tapering frusto-conical socket 2 in its lower end, which socket is practically formed into two tapering sockets by a vertically-slotted wedge-shape partition 3, extending across the socket 2 of the stock and fitted at its opposite edges to the socket and provided with a transverse slot 4. The upper end of the partition 3 is screw-threaded, as at 5, and screwed into the stock.

6 indicates a way through the upper end of the partition, leading from the slot 4 into a spring-chamber 7, provided in the stock above the partition.

8 indicates a cross-head in the slot and provided with a stem 9, extending through the way 6 into the spring-chamber.

10 indicates the spring in the spring-chamber for normally holding the stem up.

11 indicates nuts on the upper end of the stem to rest upon the spring.

12 indicates a jaw member provided with a tapering shank 13 to fit in one of the tapering shank-sockets formed between the partition 3 and the wall of the tapering socket 2 in the end of the stock. The shank 13 is provided with a cross-head socket 14 in the extended plane of the slot 4 of the partition. The jaw member is provided with a shoulder 15 to fit

against the lower end of the stock when the shank is fully seated in the tapering socket. 12' indicates a like jaw member provided with the shank 13', cross-head socket 14', and shoulder 15', and said jaw member 12' is arranged with its shank in the other socket formed therefor between the partition 3 and the wall of the tapering socket 2. The cross-head 8 is arranged to play in the slot 4, and its opposite ends are inserted in the cross-head sockets 14 14', so that the two jaw members carried by the spring 10 through the medium of the stem and cross-head.

16 indicates a spring-pressed bolt normally extending across the slot 4 in the path of the cross-head 8 to lock the cross-head against lowering. In Fig 3 the normal locking position of this bolt is indicated in dotted lines at the lower end of the view. The outer end of the bolt is provided at its upper side with a beveled face 17, which is normally chambered in a portion of the bolt-hole 18, which extends through the partition and through the stock, being closed at one end by a screw-plug 19.

20 indicates a spring in the bolt-hole to normally hold the bolt 16 normally inserted across the slot 4 with its beveled portion 17 fully beyond the slot.

21 indicates a bolt-retracting pin mounted in the bolt-hole and normally projecting from the side of the stock to be engaged and thrown by the well-casing 22 to bring the bolt 16 into position shown in solid lines in Fig. 4, with the beveled face 17 of the bolt in the path of the cross-head 8. The cross-head 8 has a beveled face 23 to engage the beveled face 17 of the bolt when the bolt is in its retracted position. (Shown in solid lines in Fig. 4.)

The spring 10 is of sufficient strength to normally hold the jaws 12 12' in their up-drawn position, with their shanks fully seated in the sockets therefor. The bolt-hole 18 is larger at the end which is closed with the plug 19 than at the opposite end, and shoulders 24 and 25 are provided to respectively prevent the bolt and the bolt-retracting pin from being thrown too far by the force of the bolt-spring 20. Preferably the bolt 16 is provided with a chamber 26 to seat one end of the spring 20, and the spring-holding plug 19 is provided with a like chamber 27 to seat the other end of the spring 20.

For convenience in assembling the parts the cross-head stem 9 is made of two parts, one of which, *a*, is integral with the cross-head and the other, *b*, is screwed to the part *a*. The part *a* of the stem together with the cross-head are of less length than the slot 4, and said stem is of greater length than the way 6, so that the part *a* and cross-head 8 can be inserted into the slot and the section *a* then pushed up through the way 6. Then the section *b* of the stem 8 is screwed onto the section *a*, after which the spring is placed in

position and the nuts 11 screwed down into place to give the appropriate tension to the spring which rests upon the upper end of the partition 3. Then the jaws 12 12' are placed against the sides of the partition with their sockets 14 14' caught over the ends of the cross-head 8, and the parts thus assembled are inserted into the conical socket 2 and turned to screw the screw-threaded upper end of the partition into the screw-threaded part therefor in the stock. 28 indicates a screw inserted through the stock and screwed into the partition to prevent the partition from unscrewing. After the parts have thus been assembled the bolt-retracting pin 21 is inserted into the bolt-hole and guideway 18. Then the bolt 16 is inserted into the bolt-hole 18 and the spring 20 is brought into place and the plug 19 screwed home. The tool is then in condition for operation.

In practical operation in order to start the tool down into the well through the casing 22 the workman will first push the bolt-retracting pin 21 in into the position indicated in solid lines in Fig. 4 and then will draw the jaws 12 12' down into the position indicated in Fig. 1. Then the tool will be let down into and allowed to pass through the casing. It is to be observed in Figs. 1 and 4 that the jaws are rounded, as at 29, so that the cutting edge of the jaws are returned when the jaws are in their down-drawn position, so that the cutting edges will not touch the casing during the descent of the tool. When the tool has passed beyond the shoe 22' of the casing, the spring 10 draws the cross-head up, thus drawing the bits up into their socket in the stock. The jaws engaging the walls of the well will be held thereby sufficiently so that the downward stroke of the stock assists the action of the spring to seat the jaw-shanks firmly in their sockets, thus bringing the shoulders 15 15' to fit firmly against the end of the stock. The spring 20 throws the bolt 16 and the pin 21 so that the beveled face 17 of the bolt is chambered in the partition, and the cross-head is thus effectually locked against drawing out of the stock on the upstroke of the stock. Whenever the tool is drawn upward so far that the pin 21 is again forced in by the shoe 22' of the casing, the bolt is thrown into its unlocking position, so that when the shoulders 15 15' of the jaws engage with the shoe 22' the cross-head is free to slip in the stock, thus to allow the stock to be drawn up while the jaws collapse into the position indicated in solid lines in Fig. 1 and in dotted lines in the upper position in Fig. 3. The tool can therefore be readily drawn out through the casing and can be lowered and raised at pleasure, and whenever it is below the casing it is ready for effective operation, as before described.

The partition 3 is flat-faced and holds the jaws spread apart when the shanks are fully

seated in the shank-sockets. The ends of the cross-head have sufficient play in their sockets to allow the jaws to swing freely toward each other as the shanks withdraw from the shank-sockets.

The bolt and its retracting-pin are to be located as close as possible to the shoulders and the cutting edges of the jaws, so that the jaws may become locked as soon as possible after passing below the lower end of the casing and will work in locked position very close to the bottom of the casing, and yet will always be fully unlocked before the shoulders can injure the bottom of the casing on an upstroke.

What we claim, and desire to secure by Letters Patent of the United States, is—

1. An underreamer comprising a stock provided with two tapering sockets in its lower end, a vertically-slotted wedge-shaped partition between the sockets, and having bolt-holes opening from the slot axially in line with each other below the top of such sockets, such stock being also provided with a spring-chamber above the partition; a jaw member provided with a tapering shank to fit in one of said sockets, and also provided with a shoulder to fit against the lower end of the stock when the tapering shank is seated in its socket, said shank being provided with a cross-head socket in the extended plane of said slot; a like jaw member having its shank seated in the other socket of the stock; a cross-head to play in the slot and having its opposite ends seated in the sockets of the shanks, respectively, and having a stem extending up into the spring-chamber; a spring in said chamber for normally holding up the stem, cross-head and jaws; a spring-pressed bolt normally extending across the slot in the path of the cross-head to lock the cross-head against lowering, said bolt having at the upper side of its end, a beveled portion normally chambered in the partition; a spring for normally holding the bolt in its locking position; and a bolt-retracting pin mounted in the bolt-hole and normally projecting from the side of the stock to be thrown by the well-casing to bring the bolt into position with the beveled portion of the bolt in the path of the cross-head.

2. The combination of a stock provided with a tapering socket in its lower end and with a spring-chamber above said socket and with a screw-threaded portion between said spring-chamber and said socket; a wedge-shaped partition fitted in the socket of the stock and provided with a transverse slot and screwed into the stock and provided with a way leading from the slot through the upper end of the partition; a cross-head in the slot and provided with a stem extending through the way into the spring-chamber; a spring in the spring-chamber for normally holding the stem up; two jaw members carried by the cross-head on the opposite sides of the parti-

tion and each provided with a tapering shank to fit the stock-socket on opposite sides of the partition and also provided with a shoulder to engage the lower end of the stock when the shanks are seated in their sockets in the stock; a spring-pressed bolt to play across the slot in the partition and provided with a beveled portion at the upper side and outer end; and a bolt-retracting pin mounted in the stock and normally projecting from the side of the stock to be thrown by the well-casing to bring the bolt into position with the beveled portion of the bolt in the path of the cross-head.

3. In an underreamer, the combination with a jaw-carrying head having a transverse guideway, of a locking-bolt for said head arranged in said guideway; a pin sliding in said guideway to retract the bolt to unlock the head; a stop for said pin being provided in the guideway; and a spring to normally press the bolt toward the stop and into locking position, and to project the pin from the head to be returned by contact with the casing.

4. An underreamer-stock provided with a socket in its lower end; a slotted, downwardly-tapering partition rigidly fixed in the socket to form two shank-seating sockets to seat the shanks of two jaws on opposite sides of said partition; a jaw on each side of said partition and a jaw-carrying head moving in the slot of said partition.

5. An underreamer comprising a stock, the lower end of which has two upwardly-tapering shank-seating sockets with a flat-faced downwardly-tapering partition rigidly fixed between said shank-seating sockets; a vertically-movable cross-head in the slot of the partition; shouldered jaws carried by said cross-head; and an upwardly-tapering shank for each socket.

6. An underreamer comprising a stock provided with a socket in its lower end; a stationary slotted partition fastened in the socket and extending from side to side thereof to form two shank-seating sockets to seat the shanks of two jaws on opposite sides of said partition; a jaw-carrying head moving in the slot of said partition; means for yieldingly holding said head up; and jaws carried by said head and having shanks seated in said sockets.

7. An underreamer comprising a stock provided with a plurality of tapering sockets in its lower end; a stationary, vertically-slotted partition separating the socket; a jaw member; a tapering shank for said jaw member, said shank being provided with a cross-head socket in the extended plane of said slot; a like jaw member having its shank seated in an opposite socket of the stock; a cross-head to play in the slot and having opposite ends seated in the sockets of the shanks, respectively, and having an upwardly-extending stem; means for yieldingly holding up the stem cross-head and jaws; a spring-pressed bolt normally extending across the slot in the path of the cross-

762,435

head to lock the cross-head against lowering, said bolt having at its upper end a beveled portion; a spring for normally holding the bolt in its locking position; and means adapted to be engaged by the well-casing to bring the bolt into position with the beveled portion thereof in the path of the cross-head.

In testimony whereof we have signed our

names to this specification, in the presence of two subscribing witnesses, at Los Angeles, 10 California, this 28th day of November, 1899.

THOS. A. O'DONNELL.
ARTHUR G. WILLARD.

Witnesses:

JAMES R. TOWNSEND,
FRANCIS M. TOWNSEND.

CONTENTS:

Application papers. O. K.

1. Rej. Jan. 6, 1900.
2. Amendment. Oct. 30, 1900.
3. Rejection. Nov. 26, 1900.
4. Amendment A. Nov. 19, 1901.
5. Rej. Dec. 3-1901.
6. Amendment B. Dec. 28, 1901.
7. Rej. Feb. 19, 1902.
8. Amdt. C. Dec. 15-02.
9. Rej. Jan. 3, 1903.
10. Amdt. D. Nov. 9-03.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
- 23.

TITLE:

Improvement in Underreamers and Drills.

[Endorsed:] No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit, Certified Copy of File Wrapper & Contents O'Donnell & Willard U.S. Patent. Filed May 8, 1917. No. 762,435. F. D. Monckton, Clerk.

Defendant's Exhibit U. S. Day Patent 403,877.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. #1540—In Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit U. S. Day Patent No. 403,877." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Day Patent 403,877. Filed May 8, 1917. F. D. Monckton, Clerk.

(No Model.)

J. E. DAY.

WELL BORING OR DRILLING APPARATUS.

No. 403,877.

Patented May 21 1889.

Fig. 1.

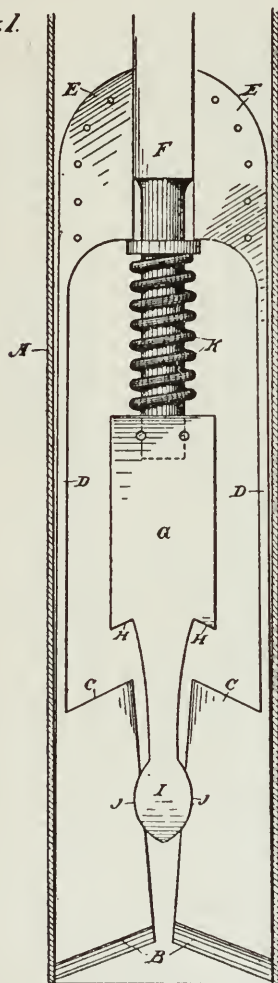
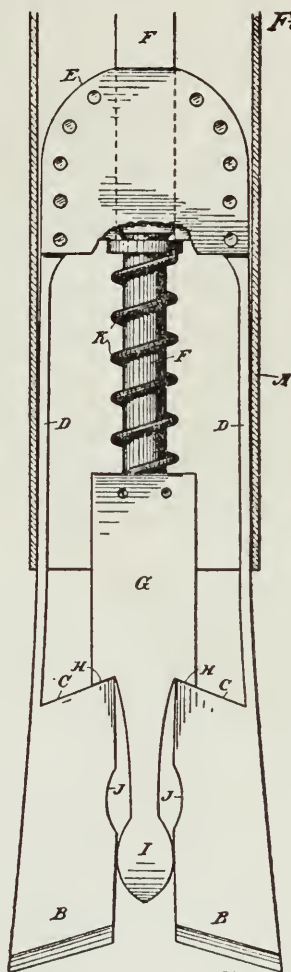


Fig. 2.



Witnesses,
Geo. H. Strong
J. H. Hulse

Inventor
Jeremiah E. Day
By Duway & Co
attys

UNITED STATES PATENT OFFICE.

JEREMIAH E. DAY, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR
OF ONE-HALF TO JOSEPH PRACY, OF SAME PLACE.

WELL BORING OR DRILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 403,877, dated May 21, 1889.

Application filed February 11, 1889. Serial No. 299,497. (No model.)

To all whom it may concern:

Be it known that I, JEREMIAH E. DAY, of the city and county of San Francisco, State of California, have invented an Improvement in Well Boring or Drilling Apparatus; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in well-drilling apparatus, and especially to that class of apparatus which is employed for drilling in rock or hard material where jars and drills are employed; and it consists in the constructions and combinations of devices, which I shall hereinafter fully describe and claim.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a vertical section taken through the well tube or casing, showing the drills and connected mechanism within the casing in position to be lowered to the bottom of the well. Fig. 2 is a view showing the drill below the bottom of the well-casing and expanded ready for work.

A is the well-casing.

B B are the drills or cutting-tools, which have their cutting-edges beveled outward, as shown. The shanks of these tools are made of considerable thickness for a short distance above the cutting-points, and at C is formed an offset or shoulder from which the remainder of the shank extends upwardly in the form of a comparatively thin plate, D, which is sufficiently elastic to allow the lower parts or cutters to open and close as much as may be necessary for the work. The upper ends are again thickened or enlarged, as shown at E. The rods from the surface come down inside the casing at F. They pass between the two sides of the drill-shanks, and, extending downwardly between the elastic portions D, the lower end of the rod F is fitted into the upper end of the block G, and is held in place by boring holes through the block, which go one half into each side of the rod F, and placing bolts or rivets therein.

At the bottom of the block G, and on each side to correspond with the shoulders C, are formed similar shoulders, H, the shoulders C and H being beveled, so that when the shoulders H rest upon the shoulders C the tendency of the bevel is to keep the drill-shanks from

spreading apart by the concussion of the blow upon the shoulders. Below the shoulders H a spear-point, I, is formed, and the thickened extensions between the drill-points B and the shoulders C are grooved or chambered out, as shown at J, sufficient to receive the spear-head I and inclose it between the sides of the concavities J.

That portion of the rod F which passes between the upper ends, E, of the drill-shanks is made square. Below this point it is made somewhat smaller and cylindrical until it enters the block G. Around this cylindrical portion is placed a stout spiral spring, K, and above this spring is a loose sliding washer, L, against which the upper end of the spring acts. This washer is of such diameter as to lie between the thin elastic portions D of the drill-shanks, and will not pass up between the upper thickened ends, E.

The lower end of the spring K presses against the top of the block G, and the tendency of the spring is to force the cutters up until the shoulders H are in contact with the shoulders C of the drill-shanks.

When the spear-head I lies within the depressions J of the drill-shanks, the points of the drills are drawn toward each other by the elasticity of their shanks D; but when the drill-shanks are forced up so that the spear-head lies between the drill-shanks below the concavities J it will spread the drill-points B apart, so that they will be of greater diameter than the exterior of the tube or casing A, and this only takes place after the drills have been lowered to the bottom of the well and below the bottom of the casing, as shown in Fig. 2.

The operation will then be as follows: The spear-head I is drawn up until it lies within the concavities J of the drill-shanks, the springs K being compressed by this action, and the shanks of the drills are contracted or drawn in sufficiently to pass easily down the well tube or casing A. As soon as the lower ends of the drills have passed out of the casing and rest upon the rock or bottom to be drilled, the weight of the rod above and the action of the spring K force the block G and the spear-head I downward until the latter has passed out of the concavities J and between the lower portions of the drill-shanks.

the drills are thus spread apart, so as to be of greater diameter than the exterior of the casing. The drill-rods are then lifted up and allowed to fall, the weight acting upon the drill-points and cutting away the bottom in the usual way, giving a diameter large enough to allow the casing to pass down freely. The shoulders H engage with the shoulders C, which are very near to the points of the drills, so that only the very thick metal intervenes between the points of the drills and the shoulders. It will be seen that the blows applied through the shoulders at this point act more directly upon the points of the drills than if they were applied at the upper ends, E, and by this construction the jar and strain is taken off from the thin elastic portions D of the drill-shanks.

When it is necessary to remove the drills from the well, by drawing up the rods the weight of the drill-shanks is sufficient to compress the spring K until the spear-head I is again brought into the concavities J, when the shanks will close up sufficiently to allow the drills to be drawn up through the well tube or casing again.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is —

1. The drill-rod having the undercut beveled shoulders at the lower end and the spear-head extending below these shoulders, as shown, in combination with the independent drill-shanks lying upon each side of the drill-rod and spear-head, the shanks of the drills being provided with shoulders corresponding with and engaging those of the rod when the latter is lowered, and having concavities or depressions within which the spear-head is inclosed when the rod is raised, substantially as described.

2. The drill-rod with undercut shoulders and spear-head, as shown, the drills inclosing said rod, having concavities within which the spear-head may lie, and shoulders which engage the shoulders upon the rod, in combination with a spring and a sliding collar or plate between which and a fixed collar upon the rod the spring is compressed, substantially as described.

In witness whereof I have hereunto set my hand.

JEREMIAH E. DAY.

Witnesses:

S. H. NOURSE,
H. C. LEE.

Defendant's Exhibit U. S. Mack Patent No. 492,371.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. No. 1540—In Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Mack Patent 492,371.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Mack Patent No. 492,371. Filed May 8, 1917. F. D. Monckton, Clerk.

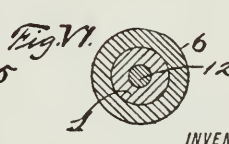
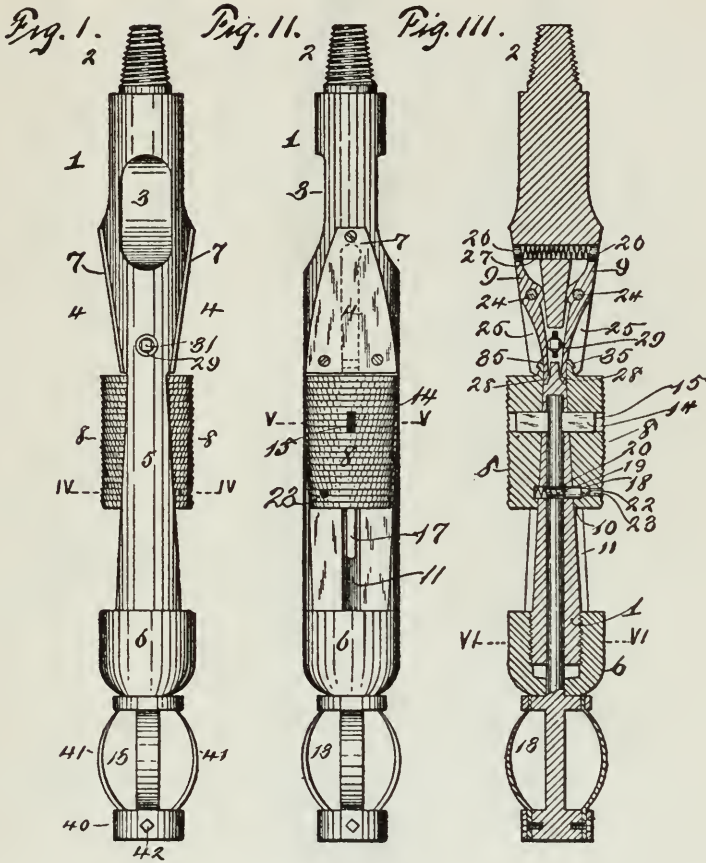
(No Model.)

2 Sheets—Sheet 1.

P. H. MACK.
CASING SPEAR.

No. 492,371.

Patented Feb. 21, 1893.



Ben R. Hagar.
J. Thomas

INVENTOR
Patrick H. Mack
BY Knight Bros
ATTORNEYS

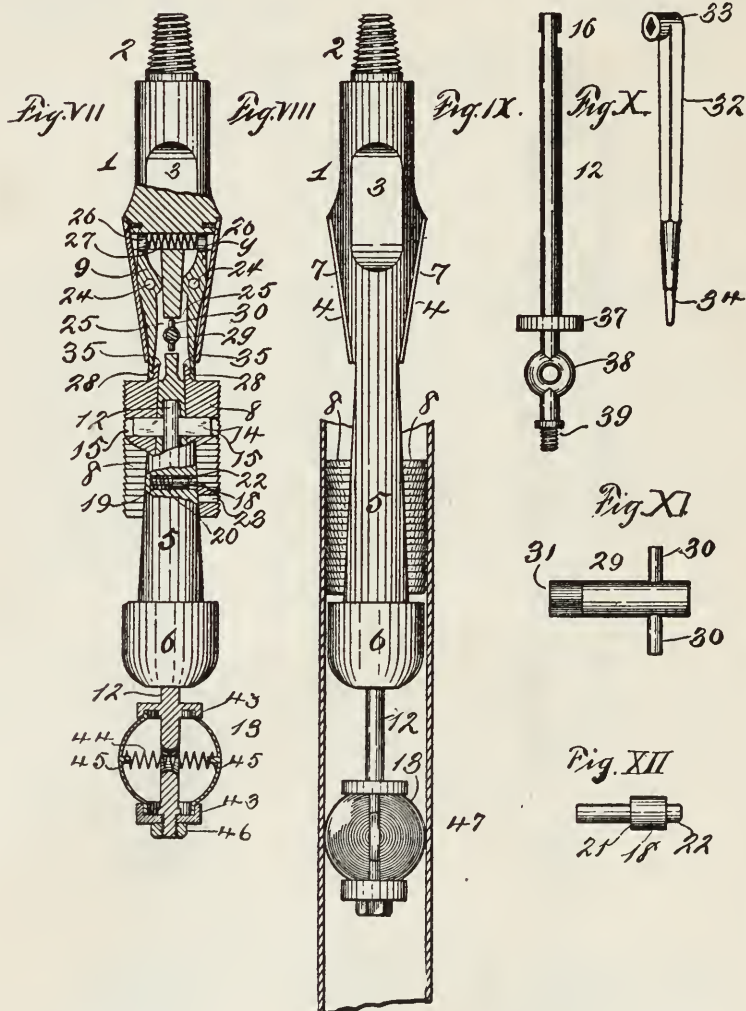
(No. Model.)

2 Sheets—Sheet 2.

P. H. MACK.
CASING SPEAR.

No. 492,371

Patented Feb. 21, 1893.



WITNESSES.
Ben R. Hagar
J. Thomas.

INVENTOR
Patrick H. Mack
BY Knights Bros.
ATTORNEYS

UNITED STATES PATENT OFFICE.

PATRICK H. MACK, OF BRADFORD, PENNSYLVANIA, ASSIGNOR TO
THE OIL WELL SUPPLY COMPANY, OF SAME PLACE.

CASING-SPEAR.

SPECIFICATION forming part of Letters Patent No. 492,371, dated February 21, 1893.

Application filed April 23, 1892. Serial No. 430,433. (No model.)

To all whom it may concern:

Be it known that I, PATRICK H. MACK, a citizen of the United States, residing at Bradford, in the county of McKean, in the State of Pennsylvania, have invented new and useful Improvements in Casing-Spears, of which the following is a specification.

My invention relates to that class of instruments for removing casing or sections of tubes from wells, in which divided slips are mounted upon a mandrel capable of longitudinal movement thereon and having a supplemental lower grip connected with the slips for the purpose of causing them to move upon the spreading mandrel and secure the initial hold upon the tube, which hold afterward is sufficient to secure that relative movement between the slips and mandrel which results in the secure gripping of the tool in the pipe.

My invention consists in certain features of novelty involved in the construction of respective parts which will hereinafter be particularly pointed out in the claims and first fully described with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation of my improved tool. Fig. 2 is a similar view of the tool in a position at right angles to that shown in Fig. 1. Fig. 3 is an axial section of the tool in a plane parallel to the plane of Fig. 1 and at right angles to the plane of Fig. 2. Figs. 4, 5 and 6 are transverse sections taken respectively on the lines 4—4 Fig. 1, 5—5 Fig. 2, and 6—6 Fig. 3. Fig. 7 is a side elevation of the tool partly in section, the plane being parallel to that of Fig. 1 and the position of the slips upon the mandrel being shifted and held in such shifted position by means of the retaining-dogs, in which position the tool is ready for use. Fig. 8 represents the tool within a tube, the slips having moved a sufficient distance upon the mandrel to secure a rigid hold upon the tube to be lifted. Figs. 9, 10, 11 and 12, are detail views respectively of the initial grip-rod, the operating-wrench, the spreading-key for forcing the dogs into the position shown in Fig. 7, and the locking bolt for locking the slips in the position shown in Fig. 3 as is done when the tool is to be withdrawn from the well without the section.

1 represents the body of the tool which is formed with a screw-head 2, flattened portion

3, beveled sides 4, mandrel 5 and cup 6. The flattened portion 3 adapts the tool for receiving a wrench which screws it on and off and from the drilling tools. The beveled sides 4 receive plates 7 which cover recesses formed in the body above the mandrel for the reception of a pair of dogs 9 which operate to retain the slips 8 in intermediate position when the tool is put into use, which position is shown by Fig. 7. The slips have dove-tails 10 which fit in corresponding grooves 11, formed parallel with the opposite faces of the tapered mandrel as shown in Figs. 2, 3 and 5, whereby said slips are held upon the mandrel and adapted to be spread by relative movement thereon. Passing centrally upward from the body of the tool, is the initial grip-rod 12 having at its lower end a peculiarly formed grip 13 and connected at its upper end with the slips 8, by means of a key 14, which passes through slots 15 in said slips, and the slot 16 in said initial grip-rod. In order to permit the movement of the slips by means of the grip-rod, the mandrel portion of the body is provided with a vertical slot 17 which communicates with the perforation through which the rod 12 passes, so that the key 14 may readily move up and down with the slips.

18 represents a bolt mounted in the recess 19 in the mandrel and outside of the axis of said mandrel, and this bolt has a spring 20 surrounding the reduced portion of the bolt and abutting against its shoulder 21, while the forward reduced end 22 of said bolt enters a socket 23 in the slip. There may be only one of these locking bolts, inasmuch as the two slips are secured together, by the key 14 or there may be two of them, one on each side. The object of this bolt 18 is to lock the slips in their uppermost position automatically, and permit the withdrawal of the tool from the well without binding.

The dogs 9 are pivoted at 24 in recess formed in the body of the tool above the mandrel, and these dogs have at their upper ends bearings 26 for a spring 27 which serves to force the ends apart, while at their lower ends said dogs are provided with hooks 28. The recess 25 is so formed as to permit the ends 26 of the dogs to set in a sufficient distance to permit the slips 8 to move up around them.

29 represents the spreading-key preferably

permanently mounted in the body transversely to the plane of the recesses 25, and this key is rendered larger on one diameter than on the other by means of pins or projections 30. This key has a square head 31 for the reception of a wrench, so that said key may be turned to force the ends 28 asunder in opposition to the spring 27.

In order to turn the key, I provide a tool 32 having a socket 33 which engages over the head 31, as will readily be seen. On the other end of this tool is a reduced projection 34 which is adapted to enter the perforation 23 and force back the bolt 18 in order that the slips may be moved downward upon the mandrel a sufficient extent to free the ends 28 of the dogs 9. When these ends are thus freed they are spread apart by the key 29. Hook projections 35 on the slips are then passed up between said dogs, after which the key is turned to its normal position, and the hooking ends 28 and 35 engage each other so as to hold the slips in the intermediate position shown by Fig. 7. When the tool is in this position it is ready for use. It may be lowered into the well until it passes within the tube-section a sufficient distance, the supplemental grip 13 being thereby compressed and caused to bind therein. The slips cannot be moved upward in this operation by the supplemental grip 13 because of the position of the ends 28 of dogs 9. Having passed a sufficient distance within the tube section, the tool is drawn upward slightly. By this operation the supplemental grip 13 operates to drag the slips away from the ends 28 of the dogs. This movement will be continued until the slips secure a hold in the wall of the tube, after which a further movement will cause the mandrel to move upward relatively to the slips and force the upwardly inclined teeth of the slips into the metal of the tube. The tool being thus securely connected with the tube section and continued movement serves to raise the latter from the well. This position of the tool in the tube is shown clearly by Fig. 8. Should it be desired to release the tube or casing for any cause, as for instance, when the tool is used for lowering the casing into the well, a sudden downward movement, will cause the mandrel to drop a certain distance relatively to the slips, the ends 28 having previously returned to their normal positions as shown in Fig. 3, whereupon the bolt 18 will enter the socket 23 in the slips and the tool will be locked into inoperative position, after which it may be withdrawn readily from the well.

For the purpose of affording a stop or abutment for the slips at the lower end of the dog, a cup 36 is screwed onto the lower end of the body as shown more clearly by the sectional view Fig. 3.

The initial grip-rod 12 carries at its lower end a collar 37 and eye 38 and the threaded end 39, to receive an additional collar 40. The supplemental grip may consist either in the

series of spring-bows 41 as shown in Figs. 1, 2 and 3 having their ends secured in sockets formed in the respective collars 37 and 40 by means of screws 42, or said supplemental grip may consist in bows 41 having their ends set between flanged collars 43 as shown in Fig. 7 and forced asunder by means of the spring 44 which passes through the eye 38 and is seated around lugs 45 formed in the inner base 41. In this form the lower collar may be secured by means of a nut 46. Or as a further modification, this supplemental grip may consist in a spherical body as 47, formed in two parts and forced asunder in any suitable manner as by means of the spring 44 shown in Fig. 7.

In using my improved casing-spear, the parts being in position shown by Figs. 1, 2 and 3, and the bolt 18 being engaged in the socket 23, said bolt is forced back by means of the end 34 of the wrench 32, after which the slips are pushed down a sufficient distance to free the lower ends of the dogs 9, so that the spreading-key 29 may be turned by the application of the head 33 of the wrench 32 to the nut 31 of said key and the dogs forced into the position shown in Fig. 7. The slips are then pushed upward until their hooked ends 35 engage the correspondingly formed ends 28 of the dogs 9, when the spear is ready to be lowered into the well. On entering the pipe or section, the auxiliary or supplemental grip 13 binds in said section but cannot operate to force the slips upward owing to the position of the dogs 9. The tool may therefore be forced a sufficient distance into the section to enable the slips to come in contact with the walls of said section. When the spear has reached the desired point it is raised so that the supplemental grip 13 through the medium of the controlling rod 12, will pull the slips down from engagement with the dogs and held down while the mandrel passes up between the slips and forces them into rigid engagement with the casing. Having reached their lower limit of movement, or being bound tightly upon the wedge-shaped mandrel, continued movement of the tool upward will draw the section with the tool. Should it be desired for any purpose to release the section, the upward movement of the tool may be suddenly reversed, when the mandrel will drop relatively to the slips a sufficient distance to allow the bolt 18, by its ends 22, to engage in the recess 23 and lock the slips in their permanent position, after which, there can be no binding effect of the slips in the section, and the tool may be withdrawn with ease.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a casing spear, the combination of the body formed with the mandrel, the longitudinally movable and expansible slips surrounding the mandrel, and the pair of locking dogs mounted in the body above the slips and

adapted to engage them and a spring connected with the dogs for holding them out of engagement when the slips are released, substantially as and for the purpose set forth.

2. In a casing-spear, the combination of the body, formed with the mandrel, the longitudinally movable and laterally expansible slips surrounding the mandrel, the pair of spring-pressed dogs mounted on the body above the slips and normally out of engagement with the slips; said slips having an extension adapted to enter between and engage the dogs, substantially in the manner and for the purpose set forth.

3. In a casing-spear, the combination of the body, formed with the mandrel, the expansible slips surrounding said mandrel whereby upward movement of the mandrel within the slips causes them to grip the tube, and the self-releasing means for preventing the relative movement between the slips and the mandrel when the tool is lowered, consisting of the notched extension on the mandrel and the pair of dogs mounted in a recess in the body and adapted by their respective ends to engage the slips, and springs for forcing them out of engagement when released from the slips, a recess being extended as shown to receive the ends of the dogs whereby the slips move up around them for the purpose explained.

4. In a casing-spear, the combination of the body formed with the mandrel, the surrounding expansible slips on the mandrel, the beveled upper portion of the body having a recess, the automatically releasing and retaining dogs, mounted in said recess, and the

plates for covering the dogs, substantially as and for the purpose set forth.

5. In a casing-spear, the combination of the body formed with the mandrel, the expansible slips surrounding the mandrel, the automatic releasing and retaining dogs for engagement with the slips as explained, and the spreading-pin located between the dogs for forcing them apart in the manner and for the purpose set forth.

6. In a casing-spear, the combination of the body formed with the mandrel, the slips mounted upon the mandrel, the supplemental grip consisting of the pair of disks, and the curved springs having their ends secured loosely in the respective disks and a rod projecting from the supplemental grip upward through the body and connected with the slips by means of the cross-key; said body or mandrel being formed with an elongated slot in which the key works, substantially as and for the purpose set forth.

7. In a casing-spear, the combination of the body formed with a mandrel and having the slips mounted upon the mandrel, and supplemental grip device adapted for frictional contact with the wall of the casing and having working connection with the slips; said supplemental grip consisting of the spherically or cylindrically formed compressible parts, with the interposed spring for forcing the parts asunder constructed in substantially the manner specified.

PATRICK H. MACK.

Witnesses:

J. W. WILLIS,
W. G. LONG.

**Defendant's Exhibit U. S. North Patent No.
674,793.**

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit U. S. North Patent 674,793." Leo Longley, Special Examiner. Filed April 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. North Patent 674,793. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 674,793.

Patented May 21, 1901.

E. NORTH.

UNDERREAMER AND EXPANSION BIT.

(Application filed Nov. 2, 1900.)

(No Model.)

Fig I

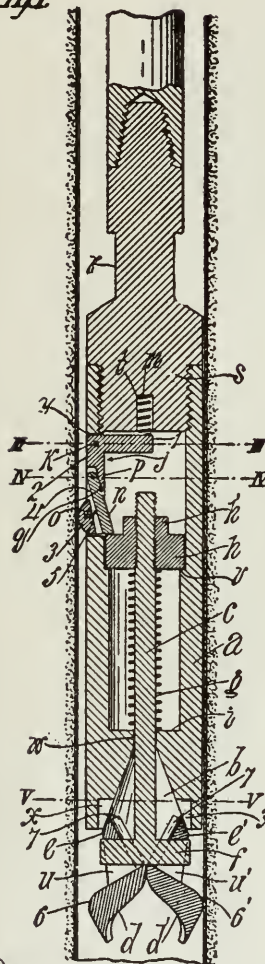


Fig I

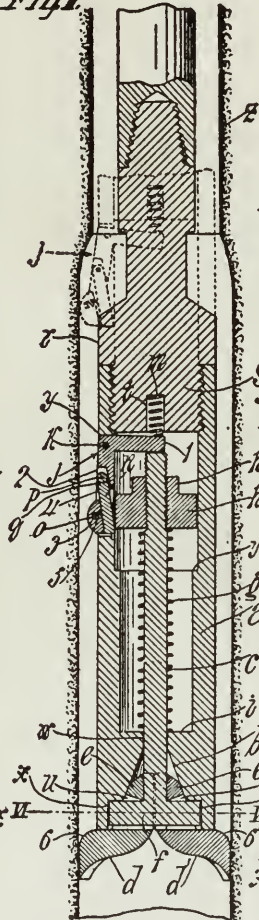


Fig II

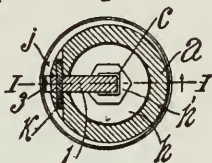


Fig IV

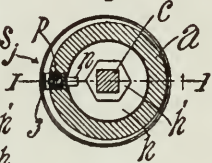


Fig V

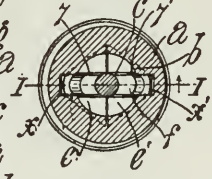
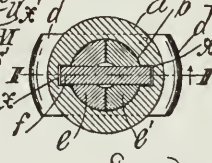


Fig VI



Inventor

Witnesses
Douglasman
J. Townsend.

Edward North
by Townsend Bros
his Atty.

UNITED STATES PATENT OFFICE.

EDWARD NORTH, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER AND EXPANSION-BIT.

SPECIFICATION forming part of Letters Patent No. 674,793, dated May 21, 1901.

Application filed November 2, 1900. Serial No. 35,281. (No model.)

To all whom it may concern:

Be it known that I, EDWARD NORTH, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Underreamer and Expansion-Bit, of which the following is a specification.

The objects of my invention are extreme simplicity, cheapness of construction, great strength, freedom from getting out of order, positive action, positive locking in collapsed position while passing through the casing, and ready unlocking and expansion upon issuing below the casing.

The accompanying drawings illustrate my invention.

Figure I is an axial section of my newly-invented underreamer and expansion-bit as the same appears in passing through the casing. Lines I I in Figs. III, IV, and V indicate the line of section. Fig. II is a like section on line II II, Fig. VI, showing the tool in operation beneath the casing. Dotted lines indicate the position of the parts of the latch just after passing through the casing. Fig. III is a plan section on line III III, Fig. I. Fig. IV is a plan section on line IV IV, Fig. I. Fig. V is a plan section on line V V, Fig. I. Fig. VI is a plan section on line VI, VI, Fig. II.

a indicates a hollow body member furnished in its lower end with an upwardly-tapering socket *b*.

c indicates a jaw or bit carrying rod sliding through such socket and extending up in the body.

d *d'* indicate two jaws pivoted to said rod and respectively furnished at their upper ends with the shanks *e* *e'* extending above the pivot *f*, which is preferably a cross-head at the lower end of the rod *c*. The shanks enter the conical socket *b*, and when fully inserted therein fit the socket snugly to hold the jaw expanded, as indicated in Fig. II, and may be withdrawn sufficiently therefrom to allow the tool to be collapsed, as indicated in Fig. I.

g indicates a spring to normally hold the rod *c* withdrawn into the body or barrel *a* of the tool, thus to hold the shanks *e* *e'* of the jaws positively seated in the tapering socket

b and the jaws consequently expanded, as shown in Fig. II.

h indicates a nut screwed onto the inner end of the rod *c* to form a projection, against which the spring *g* presses to hold the rod in normal position with the jaws expanded.

i indicates an internal shoulder in the body *a* to sustain the lower end of the spring *g*.

h' indicates a boss on the nut *h* to receive a wrench, by which said nut may be turned to screw it onto or off of the rod *c*, the inner or upper end of which is screw-threaded to receive it.

j indicates a latch-carrier pivoted to the body *a* by a pivot *k* and furnished with an inwardly-extending arm 1, acted upon by a spring *m* to normally hold the other arm 2 extended aslant outwardly and downwardly, as indicated in dotted lines in Fig. II, and to allow it to be pressed in by the casing, as shown in Fig. I. The latch-carrier arm 2 is furnished with a rounded boss 3 at its lower end to engage the casing and to be thereby pressed in when the tool is passing through the casing.

n indicates a latch pivoted in a recess 4 in the latch-carrier *j*.

o indicates a spring in a recess 5 in the latch-carrier to hold the latch *n* normally impressed.

p indicates the pivot of the latch, by which it is pivoted in the recess 4 in the latch-carrier.

The spring *o* normally holds the latch in position, with its inner face aslant inward and downward, so that the nut *h* will readily pass down past the latch *n*, and so that after the nut *h* has passed the latch it will project inward above the nut *h* to prevent it from being thrown up by the spring *g*. The pivot *p* of the latch *n* is located above a stop *q*, formed by the inner wall of the recess 4, in which the latch *n* is pivoted, and the spring *o* is located below the stop, so that the stop prevents the latch from being thrown too far in by the spring *o*.

r indicates the barrel-carrying tool shank or stock, furnished with a screw-threaded pin *s*, which screws into the top of the barrel or body *a*. The spring *m* is seated in a socket *t* in the lower end of the pin. The cross-head *f* is seated in perforations or holes *u* *u'* in the

674,793

shanks $e\ e'$ respectively, and the holes are of sufficient size to allow the jaws to drop down into their collapsed position whenever the rod c is forced down into position to allow the shanks to spread apart in the socket.

v indicates a shoulder in the barrel or body a , which forms a stop for the nut h , thereby affording positive means to prevent the rod c from being drawn too far down. The rod c is angular in cross-section throughout the lower portion of its body and passes through an angular way w in the barrel or body a and which forms the termination of the tapering socket and is thereby prevented from turning. To afford more perfectly secure means to prevent the jaws from turning relative to the barrel when the tool is at work, sockets $x\ x'$ are provided at the lower end of the body, being lateral extensions of the opposite sides of the conical seat b , and the cross-head f extends laterally beyond the shanks $e\ e'$ to fit into said sockets $x\ x'$ when the rod is retracted to hold the shanks $c\ e'$ seated in the tapering socket.

In practical use the tool is assembled by inserting the angular rod c through the tapering socket and through the angular hole w and bringing it into position, with the cross-head sufficiently extended to allow the shanks $e\ e'$ to be mounted thereon with the opposite arms of the cross-head inserted in the holes $u\ u'$, respectively. Then the rod will be further inserted and the shanks fully seated in the tapering socket b . Then the spring g will be placed in the other end of the barrel or body and around the rod c . Then the nut h will be screwed into position to prevent the rod from withdrawing sufficiently to allow the shanks to be fully withdrawn from the socket, but allowing the shanks to be withdrawn sufficiently to collapse the tool, as shown in Fig. I. Then the carrier j , with its latch n in position, as shown, will be placed in the openings y , provided therefore in the side of the barrel or body and will be fastened by the pivot k . Then the spring m will be seated in its socket t in the stock or shank r of the tool, and said shank or stock will be screwed into the upper end of the barrel or body a , so that the spring m acts upon the upper arm 1 of the latch-carrier j to hold the lower arm of such carrier projected, as indicated by dotted lines in Fig. II. The spring o will yieldingly hold the latch n inward, so that when the operator desires to lower the tool through the casing z he may draw downward in the jaws $d\ d'$, thus drawing the nut h past the latch n , which will then be thrown inward by spring o to project above the nut h , thus to hold the rod c from being retracted by the spring g . The walls of the seat y for the latch-carrier j prevent the lower end of such carrier from being thrown too far out by the action of the spring m when the rod is thus extended from the tool. Sufficient space is provided to allow the latch n to swing out-

ward far enough to allow the nut to pass readily down; but the spring o holds the latch in to prevent the return of the nut.

The operator in order to allow the tool to descend through the casing will draw the jaws out, as shown in Fig. I, and will then allow the tool to pass down through the casing. The latch n will be held in by the lower end of the carrier and by the spring o until the boss 3 passes below the casing, whereupon the spring m will throw the carrier out sufficiently to withdraw the latch n from above the nut h , thus allowing the rod-carrying spring g to retract the rod and bring the jaws and their shanks into the position shown in solid lines in Fig. II. Dotted lines in Fig. II indicate the position the latch and latch-carrier will assume immediately after the boss 3 has escaped from the casing. After the nut is thus released the spring g will throw the rod up, and the same will engage the arm 1 and will bring the carrier back into the position shown in solid lines in Fig. III.

When it is desired to withdraw the tool through the casing, it will be drawn upward and the upper rounding faces or shoulders 6 6' of the jaws $d\ d'$ will engage the lower end of the casing, and thereby as the tool passes through the casing the jaws will be drawn down into and will be held in the position shown in Fig. I, thus allowing the tool to be withdrawn from the casing.

The shanks $e\ e'$ are channeled by longitudinal channels 7 7' to snugly chamber the rod c , so that when the shanks are fully seated in the tapering socket b the parts at the lower end of the tool will fit together, so as to form a practically solid body.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. An underreamer or expansion-bit comprising a hollow body member furnished in its lower end with an upwardly-tapering socket; a rod sliding through such socket and extending up in the body; two jaws pivoted to said rod and respectively furnished at their upper ends with a shank extending above the pivot to enter the tapering socket, thereby to hold the jaws expanded; and resilient means for normally retracting the shank to hold the jaw-shanks in the socket.

2. An underreamer or expansion-bit comprising a hollow body member furnished in its lower end with an upwardly-tapering socket; a rod sliding through such socket and extending up into the body; two jaws pivoted to said rod and respectively furnished at their upper ends with a shank extending above the pivot to enter the tapering socket, thereby to hold the jaws expanded; means to prevent the rod from turning in said body; and resilient means for normally holding the shank up to hold the jaw-shanks in the socket.

3. An underreamer or expansion-bit comprising a hollow body member furnished in its lower end with an upwardly-tapering socket;

a rod sliding through such socket and extending up in the body; two jaws pivoted to said rod and respectively furnished at their upper ends with shanks extending above the
5 pivot to enter the conical socket and hold the jaws expanded; resilient means for normally holding the shank up to hold the jaw-shanks in the socket; and positive means to prevent the jaw-shanks from being wholly withdrawn
10 from the socket.

4. An underreamer or expansion-bit comprising a hollow body member furnished in its lower end with a tapering socket, the upper end of which socket terminates in an angular
15 way; a rod fitted in said way and sliding through said socket and way and extending up in the body; two jaws pivoted to said rod and respectively furnished at their upper ends with shanks extending above the pivot
20 to enter the conical socket to hold the jaws expanded; and resilient means for normally holding the shank up to hold the jaw-shanks in the socket.

5. An underreamer or expansion-bit comprising a hollow body member furnished in its lower end with a tapering socket; a rod sliding through such socket and extending up in the body; two jaws pivoted to said rod and respectively furnished at their upper ends
30 with shanks extending above the pivot to enter the conical socket to hold the jaws expanded; resilient means for normally holding the rod up to hold the jaw-shanks in the socket; means to prevent the complete withdrawal of the shanks from the socket; a latch-carrier furnished with a bearing to engage

the casing to hold a latch in operative position to lock the rod down while the bearing is in contact with the casing; a latch carried by said carrier; and a spring to throw said latch-carrier to release the rod when the bearing is released from the casing.

6. An underreamer or expansion-bit comprising a hollow body member furnished in its lower end with a tapering socket; a rod sliding through such socket and extending up in the body and furnished at its lower end with a cross-head; two jaws pivotally carried by said cross-head and respectively furnished at their upper ends with shanks extending above the cross-head to enter the conical socket to hold the jaws expanded; seats on the opposite sides of the socket to receive the ends of the cross-head; and resilient means for holding the rod up with the cross-head in its seats

7. The combination of the jaws of the jaw-carrying rod; the body in which said rod plays; resilient means for retracting the rod in the body; a latch-carrier pivoted to the body and furnished with a bearing to engage the well-casing; a latch pivoted to the latch carrier; a spring for yieldingly holding such latch inward; and a spring for yieldingly holding the carrier outward.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles California, this 24th day of October, 1900.

EDWARD NORTH.

Witnesses:

JAMES R. TOWNSEND,
JULIA TOWNSEND.

**Defendant's Exhibit U. S. Kellerman Patent No.
679,384.**

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Kellerman Patent No. 679,384.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit 679,384. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 679,384.

Patented July 30, 1901.

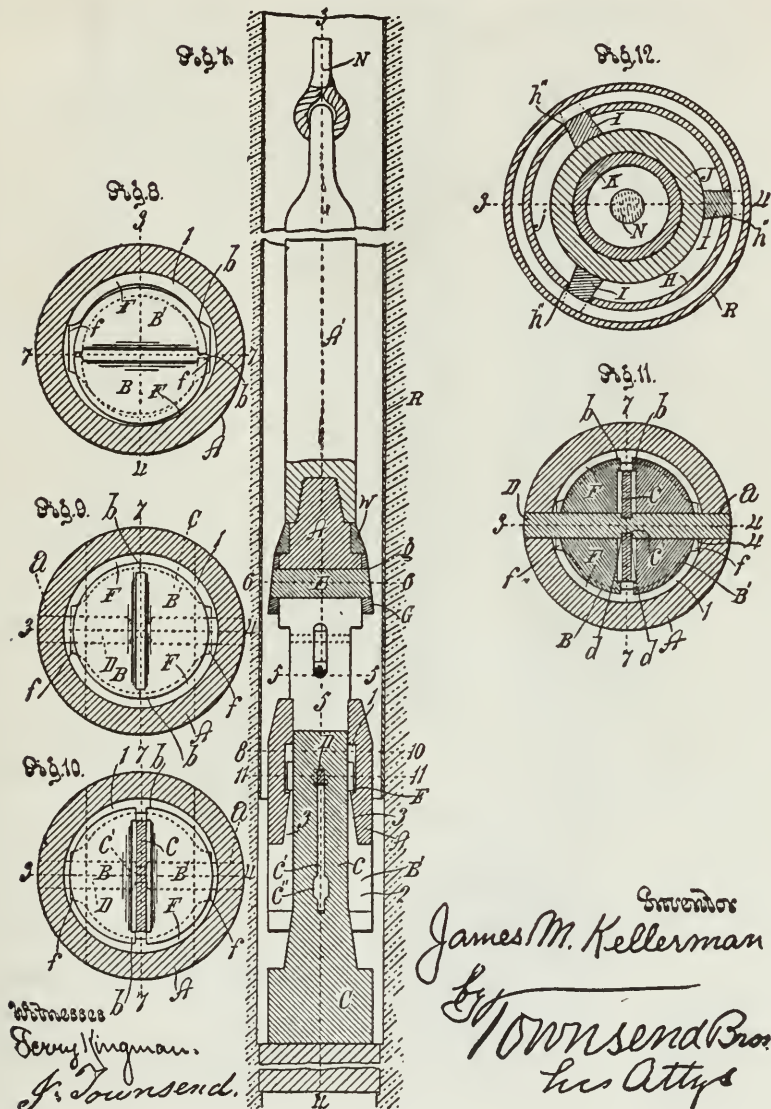
J. M. KELLERMAN.

EXPANDING UNDERREAMER AND DRILL.

(Application filed Oct. 16, 1899.)

(No Model.)

3 Sheets—Sheet 2.



James M. Kellerman
By Townsend Bros.
his Attys

Serry Kingman.
J. Townsend.

No. 679,384.

Patented July 30, 1901.

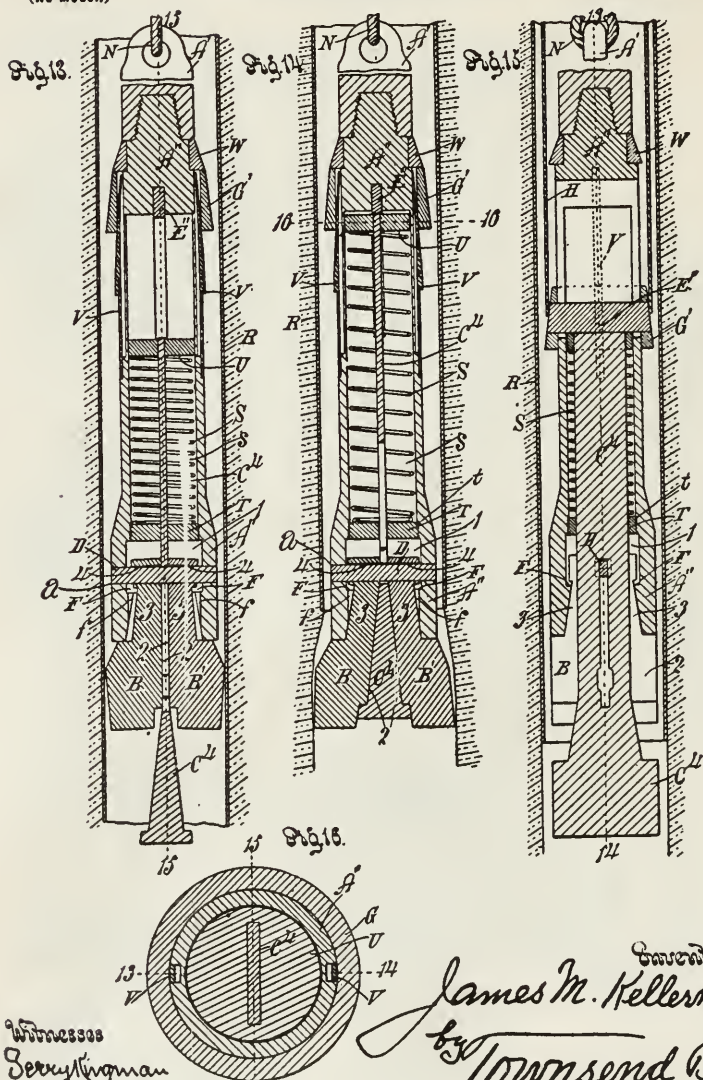
J. M. KELLERMAN.

EXPANDING UNDERREAMER AND DRILL.

(Application filed Oct. 10, 1899.)

(No Model.)

3 Sheets—Sheet 3.



Witnesses
 Perry Kingman
 J. Townsend.

Inventor
 James M. Kellerman
 by Townsend Broa
 his Attys.

UNITED STATES PATENT OFFICE.

JAMES M. KELLERMAN, OF LOS ANGELES, CALIFORNIA.

EXPANDING UNDERREAMER AND DRILL.

SPECIFICATION forming part of Letters Patent No. 679,384, dated July 30, 1901.

Application filed October 16, 1899. Serial No. 733,800. (No model.)

all whom it may concern:

Be it known that I, JAMES M. KELLERMAN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Expanding Underreamer and Drill, of which the following is a specification.

The object of my invention is to provide a practical tool for drilling a hole larger than the casing or for underreaming a hole underneath the casing in a well.

In carrying out my invention I have provided positive means for expanding the bit or reamer and for releasing the bits to allow them to collapse in order to draw the tool out of the casing. I also provide against the use of any pivot-bolts in positions where any strain of the work will be applied.

It is an object of my invention to produce a tool of great strength which will not be liable to become broken and which will not be liable to come to pieces and drop any of its parts in the hole being drilled. In this device the expanding bits are loosely supported in a chambered stock by shoulders and are thrown outward at their lower ends by a wedge, and the wedge may be held in wedging position by a catch or by a spring or by both a catch and a spring. The catch may be of different forms and the device may be varied in its form without departing from my invention.

In the accompanying drawings I have shown the device in two of the forms in which it may be embodied. The wedge is shown both with and without a wedge-sustaining spring.

Figure 1 is a fragmental elevation showing my invention in a well with parts in position ready for expanding the bits for reaming beneath the well-casing, which is shown drawn up for a distance in order to allow a plug to be let down to the reaming-shoulder of the wall of the well below the casing, so as to hold the wedge while the tools are lowered on the wedge, thus to expand the bits. This plug is only required for underreaming beneath the casing when the tool is not provided with a wedge-sustaining spring. In case the tool is used as a drill the bottom of the hole will serve the purpose of the plug shown in this view. Where a wedge-sustaining spring is used, such spring serves the purpose of the plug. Fig. 2 is a fragmental elevation, on a

larger scale, showing more in detail the parts shown in Fig. 1. Parts are broken away to contract the view. Fig. 3 is a fragmental sectional detail in the plane indicated by line 3 4, Figs. 5, 6, 6a, 7, 8, 9, 10, 11, and 12. The parts are not shown in the same position in all of the views. In Figs. 1, 2, and 3 the tool is shown collapsed. Fig. 4 is a fragmental axial section on the same plane as Fig. 3, but showing the parts in position when the tool is expanded. Fig. 5 is a plan indicated by line 5 5, Figs. 2, 3, 4, and 7, with the wedge in wedging position and the bits expanded. Fig. 6 is a plan 65 section on plane indicated by line 6 6, Figs. 2, 3, and 7. Fig. 6a is a plan section on line 6a 6a, Fig. 4. Fig. 7 is a sectional elevation on a plane indicated by line 7 7, Figs. 2, 3, 8, 9, 10, and 11, the stock being sectioned only in part. 70 Fig. 8 is a section on a plane indicated by line 8 10 in Figs. 1, 2, 3, 4, and 7. In this view one of the bits B is shown fully inserted into place with its projection over the shoulder of the stock, while the other bit B' is 75 shown in the inserting position. Fig. 9 is a plan section on said plane 8 10 in Figs. 2 and 3, showing the bits inserted and turned a quarter-turn from the position shown in Fig. 8, so that the bits cannot be withdrawn. Fig. 80 10 is a section on line 8 10, Figs. 1, 2, 3, and 7, with the wedge in place. Fig. 11 is a section on plane indicated by line 11 11 in Figs. 2, 3, 4, and 7. Fig. 12 is a section on line 12 12, Figs. 1, 2, 3, and 4, with the parts in the 85 position indicated in Fig. 3. Fig. 13 is a vertical axial section of my invention as applied with a wedge-sustaining spring. The tool is shown in the act of descending in the casing. Line 13 14, Fig. 15 and 16, indicates the 90 plane of section in Figs. 13 and 14. Fig. 14 is a view of the tool shown in Fig. 13 when the bits are expanded. Fig. 15 is an axial mid-section on line 15 15, Figs. 13 and 16. Fig. 16 is a plan section on line 16 16, Fig. 14. 95

My newly-invented expansion-drill and underreamer comprises a stock A, provided with a transverse opening or way a and with an axial shouldered chamber 1; two bits B B', each being flat on its inner face 2 and hav- 100 ing a circumferentially-channeled neck 3 to seat in opposite sides of said chamber and also provided with a transverse way 4 to register with the transverse way a of the stock

A; a wedge C to seat between the bits BB' to hold them in expanded position and provided with a stem or upward extension *c*, which has a slot *c'* to register with the ways of the bits 5 and stock; a pin D, inserted through the ways of the stock, bits, and stem; means for temporarily holding the wedge in its wedging position, and means for forcing the wedge out of wedging position. The stock A is provided with a slot 5, extending across and lengthwise of the stock at its upper end, the axial chamber 1 and the transverse opening or way *a* being at the lower end of the bit.

E indicates a pin inserted through the stock-slot 5 to engage the head of the wedge-stem *c* to force the wedge downward when it is desired to contract the reamer.

F indicates the shoulder of the wall of the chamber 1. The neck of each of the bits is provided with a projection *b* to fit over the shoulder F when the neck is sufficiently inserted into the chamber. The shoulder F of the chamber is notched, as at *f*, on opposite sides of said chamber.

In Fig. 8 one of the bits B is shown fully inserted into the chamber 1, and the other bit B' is shown in position for being inserted. The notches *f* allow the ends of the projection *b* of either of the bits to pass the shoulder F while the part B is fully inserted, as shown, and the part B' is laid on top of it, with the notches *f* at opposite edges of the joint between the two bits. When the two bits have been fully inserted and are turned a quarter of the way around, (from the position shown in Fig. 8,) as indicated in Fig. 9, neither one of them can be withdrawn from the stock, for the reason that the ends of the projection *b* will be stopped by the shoulder F. This positively secures the bits against all danger of dropping out. When the bits are in this position, the wedge C will be inserted to bring its stem *c* up into the stock between the bits B and B' and to project above the tops of said bits.

Any suitable means may be provided for temporarily holding the wedge in its upmost position for expanding the bits. In Figs. 1, 2, and 3 I have shown a latch for this purpose, and in Figs. 13, 14 and 15 I have shown a spring for this purpose.

I will now describe the means for forcing the wedge down.

G indicates a sliding member upon the stock A and provided with a keyway *g*. The key or pin E, which is to engage the top of the wedge-stem *c*, is mounted in the keyway *g* of the sliding member G and also in the slot 5 of the stock. This key extends in the path of the stem or extension *c* of the wedge. I provide suitable means for forcing the sliding member downward.

H indicates a weighted member having an upward extension *h*. Said weighted member is arranged to engage the sliding member G to force it downward. The weighted member preferably consists of a piece of pipe or

tube of considerable length to slide up and down with relation to the stock of the drill or reamer. I indicates friction-blocks mounted to slide radially of said weighted member to engage and disengage the walls of the well-easing. The outer faces of these blocks are preferably roughened, as indicated in Fig. 2. One or more of these blocks may be provided, as desired; but I prefer to use three friction-blocks, as indicated in Fig. 12, the same being arranged to slide radially of the extension *h* of the weighted member and being set at equal distances around a wedge J, which is provided for forcing said friction-blocks outward to engage the well-easing. The blocks are preferably wider at their inner portion than the way in which they slide, thus to prevent dropping out.

K indicates a carrier and jar for the block-wedge J. Said carrier moves independently of said wedge to serve as a jar for the wedge. The bail L and rope M constitute means for raising and lowering the carrier independently of the stock A, which is raised by the usual means, such as the rope N. The carrier K is provided with stops *kk'* to limit the movement of the carrier with relation to the wedge J, and the wedge J is provided with a stop *j* to engage with the stop *h'* on the weighted member H. The stop *h'* is preferably formed by the lower end of the extension *h* of the weighted member H. The weighted member H is preferably a long section of iron pipe, and the extension *h* is a shorter section of iron pipe screwed into the top of the long section, the extension *h* being slotted, as at *h''*, to receive the friction-blocks I. The wedge J is preferably a frustum of a hollow inverted cone, which fits around the body of the carrier K. The cone tapers downward, so that when the wedge is lowered with relation to the blocks I it will force said blocks I out through the slots *h''* of the extension *h*. By referring to Figs. 3 and 4 it will be seen that after the wedge C has been brought to rest the weighted member H may be lowered to rest upon the member G and that when the weighted member H engages the member G it will then be held from further descent unless it drives the member G down. If it comes to rest without driving the member G down, the carrier K will then be lowered until the projection or stop *k'* at the top of the carrier engages the top of the wedge J. The weight of the weighted member H and carrier K will then be exerted to force the wedge J downward, thereby wedging the blocks I out to firmly engage the easing R. If desired to wedge the blocks with considerable force, this can be done by raising and lowering the carrier K, which is made of metal, and allowing it to strike upon the top of the wedge J after the manner of operating jars. When the blocks have thus been wedged securely, so as to hold the weighted member H firmly, the tools will be drawn upward by the rope N, while the weighted member H remain

stationary by reason of the blocks I. This causes the ring G to remain stationary while the stock A slides up.

In Figs 2, 3, and 4, O indicates a latch pivoted in the stock A and provided with a catch O' to catch in a notch c" in the stem of the wedge. When the stock is drawn upward through the ring member G, a portion P of the latch engages the ring G and is therefore forced inward against the pressure of the spring Q, which normally holds it out in the path of the ring or sliding member G. The portion or handle P has a sloping face to engage with the ring G, so that as the tool is drawn up the catch is withdrawn from the notch c" in the stem of the wedge, thus releasing the wedge and allowing the key E, which engages the top of the wedge, to force the wedge down, thus to withdraw it from between the bits and allow the bits to collapse as they are drawn up through the casing.

In the form shown in Figs. 13, 14, 15, and 16 a spring S is provided in the stock around the stem c⁴ of the wedge C⁴. The spring is held in the barrel by a plug T, which is screwed into the lower end of the spring-chamber s. U indicates the head of the stem c⁴ of the wedge. The spring S presses up on the head U and normally holds the wedge C⁴ in the wedging position. V indicates spring-locks arranged to catch over the top of the sliding member G when such member is brought down into its lowest position, as indicated in Figs. 15 and 16, thus to hold the member G down to allow the tool to be drawn out of the casing. W indicates a shouldered protrusion on the stock to protect the upper end around the sliding member G.

Referring to Fig. 7, it will be noted that a slot c' in the stem c of the wedge is provided with an enlargement C" a short distance above the lower end of the slot, and by referring to Fig. 11 it will be seen that the pin D is notched at the middle, as indicated at d, the lower notched portion fitting the narrow portion of the slot c', while the body of the pin D on each side of the notch is of a width to prevent its slipping through the enlarged portion c" of the slot. By this means the pin D can be inserted only by bringing the notch c" to register with the way a. Then the pin D may be drawn in or out, as the case may be; but when the wedge C is at its upper or lower position of movement it is impossible to withdraw the pin D. This insures against any accidental loss of the pin D. The wedge-driving pin E is held in place by riveting or fastening the outer ends of said pin after the has been inserted through the stock and the ring G. The ring-retaining member W is held in place by the stem A', which is screwed into the end of the stock in the ordinary manner.

The cross-head U of the spring-supported wedge-stem c⁴ is held in place by riveting or fastening the top of the wedge-stem at the head of the cross-head.

The way for the pin E is arranged at right angles to the way for the pin D and extends over the top of the stem of the wedge, in the line of the width of said stem, so as to engage with the entire top of said stem.

To assemble the tool shown in Figs. 13, 14, and 15, the plug T will be slid onto the stem, and the spring S brought into place and secured by the cross-head U, which is fastened in place by battering or riveting the end of the stem c⁴. Then the cross-head U, the stem c⁴, spring S, and plug T will be inserted into the chamber s of the stock, and the wedge and its stem will then be rotated, thus turning the plug T until it is screwed well into the screw-threaded seat t therefor in the stock and the wedge held with its width extending in a line drawn from one notch f to the other. Then the bits will be inserted, one at a time, as suggested by Fig. 8, and when in place the wedge and bits will be turned a quarter-way around and the wedge brought into position to allow the pin D to be inserted. When the pin D is in place, the tool is ready for use.

To lower the tool shown in Figs. 13 to 16 into one well, the wedge will be drawn down, as indicated in Fig. 13, and the tool collapsed. Then the bits will be inserted into the casing, which will hold them from expanding until they are below the casing. When the bits are lowered to beneath the casing, the spring causes the wedge to force them out, so that they begin to cut the walls of the well, and upon further operation of the tool the bits will cut their way into the walls, being forced out by the updrawn wedge until the bits are fully expanded. When it is desired to withdraw the tool from the well, the rope M will be lowered to lower the member H, carrier K, and wedge J, and to force the ring G downward or to hold it while the stock of the tool is drawn upward by the rope M, thereby withdrawing the wedge from beneath the bits and drawing the ring G' down below the catches V, thus to prevent the spring from again drawing the wedge C⁴ up to expand the bits. Then the rope M will be drawn upward to lift the carrier K and the wedge J, and thus release the blocks I and allow the sliding member H to be drawn up. Then the tools can be drawn out of the well.

A" in Figs. 13, 14, 15, and 16 indicates the form of stock provided with the wedge-lifting spring, and E' indicates the wedge-operating pin, which strikes upon the head of the wedge-stem c⁴. With these exceptions like characters represent like parts in the several views.

In operating the form shown in Figs. 1, 2, and 3 when the tool is used as an underreamer a block of wood X is dropped into the well to lodge at the reaming-shoulder beneath the casing. The casing being drawn up for a distance above the underreaming-shoulder, the tool will be lowered into the well until the wedge C rests upon the block X.

X. Then the tool will be lowered to force the wedge between the jaws until the catch O' catches in the notches c', thus holding the wedge in place. Then the tool will be operated in the ordinary manner, and the block X will be driven down and broken up by the bits, to be afterward removed in the ordinary course of work.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. An expansion-drill and underreamer comprising a stock provided with a transverse opening or way and with an axial shouldered chamber; two bits, each being flat on its inner face and having a circumferentially-channeled neck to seat in opposite sides of said chamber, and also provided with a transverse way to register with the transverse way of the stock; a wedge to seat between the bits to hold them in expanded position and provided with a stem which has a slot to register with the ways of the bits and stock; a pin inserted through the ways of the stock, bits and stem; means for temporarily holding the wedge in its wedging position; and means for forcing the wedge out of wedging position.

2. An expansion-drill and underreamer comprising a stock having a shouldered chamber and a transverse opening or way at its lower end; two bits, each provided with a neck to seat in opposite sides of said chamber and also provided with a transverse way to register with the lower transverse way of the stock; a wedge to seat between the bits to hold them in expanded position and provided with a stem which has a slot to register with the ways of the bits; a pin inserted through the ways of the stock, bits and stem; means for temporarily holding the wedge in its wedging position; and means for forcing the wedge out of wedging position.

3. An expansion-drill and underreamer comprising a stock with a slot extending across and lengthwise of the stock at its upper end and with an axial chamber and a transverse opening or way at its lower end; two bits, each provided with a neck to seat in opposite sides of said chamber and also provided with a transverse way to register with the lower transverse way of the stock; a wedge to seat between the bits to hold them in expanded position and provided with a stem which has a slot to register with the ways of the bits and which stem extends into said slot of the stock when the wedge is seated to hold the bits expanded; a pin inserted through the ways of the stock, bits and stem; means for temporarily holding the wedge in its wedging position; a pin inserted through the stock slot to engage the head of the stem; and means for operating said last-named pin to force the wedge out of its wedging position.

4. In an expanding bit and underreamer, the combination of a stock provided with a chamber at its lower end, the walls of said chamber being shouldered; two bits, each provided with a neck to seat in said chamber

and provided at the upper end with a projection to fit over said shoulder when the neck is inserted; a wedge to wedge between said bits and provided with a stem to extend above the upper ends of said necks and to hold the necks outward with their projections over the shoulder; means for retaining the wedge in the stock; means for temporarily holding the wedge in its wedging position; and means for forcing the wedge out of its wedging position.

5. An expanding bit and underreamer comprising a stock provided at its lower end with a chamber with shouldered walls, the shoulder being notched on opposite sides of said chamber; two bits, each provided with a neck having a projection to extend over said shoulder to prevent withdrawal of the bits when the two bits are inserted and are turned to bring such projections over the shoulder away from the notches thereof; the ends of said projections being adapted to pass through the notches when the bit is brought into position for that purpose; and means carried by the stock for spreading the bits apart.

6. In an expanding bit and underreamer, the combination of a stock provided at its lower end with a transverse keyway and with a chamber with shouldered walls, the shoulder being notched on opposite sides of such chamber; two bits, each provided with a neck having a projection to extend over such shoulder when the bits are in position for that purpose and to pass through the notches when adjusted for that purpose; each of said bits being provided with a transverse hold or keyway, the two holes registering with said way of the stock when the bits are turned to bring the projections over the shoulder; a wedge provided with a stem inserted between the bits and provided with a slot to register with the said keyways; a key inserted in said keyways; and means for adjustably holding the wedge in its wedging position.

7. An expanding bit and underreamer comprising a slotted stock; two bits loosely secured in the lower end of the stock; a wedge for forcing the bits apart; a sliding member upon the stock and provided with a keyway a key in said keyway and slot and extending in the path of an extension of the wedge means for temporarily holding the wedge in its wedging position; and means for forcing the sliding member downward.

8. An expanding bit and underreamer comprising a slotted stock; two bits loosely secured in the lower end of the stock; a wedge for forcing the bits apart; a sliding member upon the stock and provided with a keyway a key in the keyway and slot and extending in the path of an extension of the bit-wedge means for temporarily holding the bit-wedge in its wedging position; a weighted member to engage the sliding member to force it downward; one or more friction-blocks mounted to slide radially of said weighted member to engage the walls of the well-casing; a wedge

for forcing said friction-blocks outward to engage the casing; a carrier for the block-wedge; and means for raising and lowering the stock.

9. The combination with operative parts of a well drilling or reaming tool, of a weighted member; one or more friction-blocks mounted to slide radially of said weighted member to engage the walls of the well-casing; a wedge for forcing said friction-blocks outward to engage the casing; and a carrier and jar for said wedge.

10. The combination with operative parts of a well drilling or reaming tool, of a weighted member; one or more friction-blocks mounted to slide radially of said weighted member

to engage the walls of the well-casing; a wedge for forcing said friction-blocks outward to engage the casing; and a carrier and jar slidably connected with the wedge and provided with stops to limit its movement relative to the wedge.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles, California, this 7th day of October, 1899.

J. M. KELLERMAN.

Witnesses:

JAMES R. TOWNSEND,

FRANCIS M. TOWNSEND.

Defendant's Exhibit U. S. Patent to Mack No. 496,317.

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Patent to Mack No. 496,317.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Patent to Mack No. 496,317. Filed May 8, 1917. F. D. Monckton, Clerk.

(No Model.)

P. H. MACK.

2 Sheets—Sheet 1

ENLARGING UNDER BEAMER FOR OIL OR ARTESIAN WELLS.

No. 496,317

Patented Apr. 25, 1893.

Fig. 1.

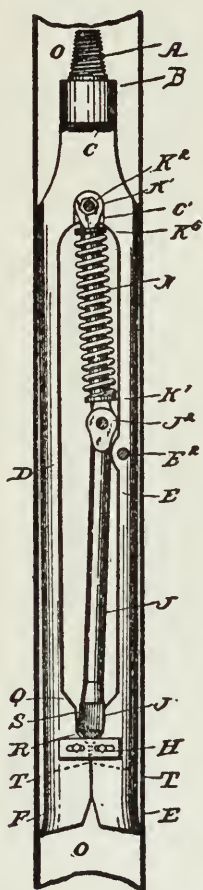
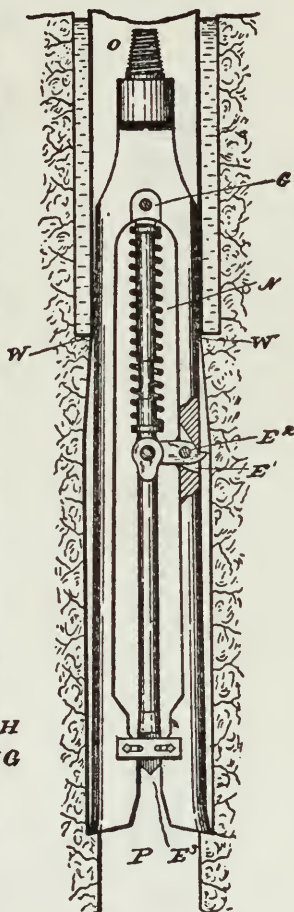


Fig. 2.



Fig. 3.



WITNESSES:

George E. Paine,
E. H. Knight.

Fig. 4.



INVENTOR

P. H. Mack

BY

Knight Bros

ATTORNEYS.

(No Model.)

2 Sheets—Sheet 2.

P. H. MACK.

ENLARGING UNDER REAMER FOR OIL OR ARTESIAN WELLS.

No. 496,317.

Patented Apr. 25, 1893.

Fig. 5.

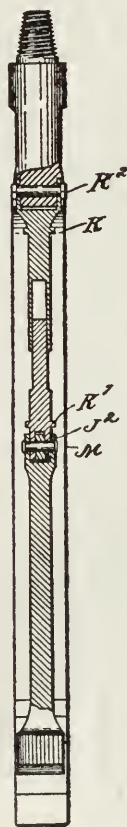


Fig. 6.

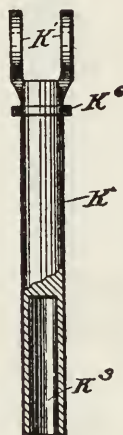


Fig. 7.



Fig. 8.

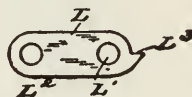
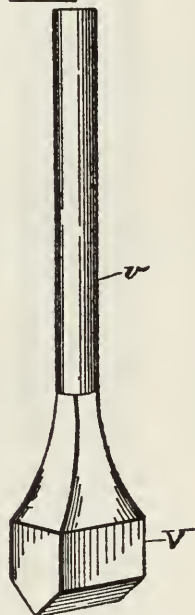


Fig. 9.



WITNESSES:

George C. Conner
E. D. Knight

INVENTOR

P. H. Mack
BY *Knight Bros*
ATTORNEYS

UNITED STATES PATENT OFFICE.

PATRICK H. MACK, OF BRADFORD, PENNSYLVANIA.

ENLARGING UNDER REAMER FOR OIL OR ARTESIAN WELLS.

SPECIFICATION forming part of Letters Patent No. 496,317, dated April 25, 1893.

Application filed May 20, 1892. Serial No. 433,789. (No model.)

To all whom it may concern:

Be it known that I, PATRICK H. MACK a citizen of the United States, residing in the city of Bradford, in the county of McKean and State of Pennsylvania, have invented certain new and useful Improvements in Enlarging Under Reamers for Oil or Artesian Wells; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a longitudinal elevation of my improved tool, shown in the casing with the reaming-bits close together. Fig. 2 is a side elevation of the tool in a position at right angles to that shown in Figs. 1 and 3. Fig. 3 is a longitudinal elevation of the tool in the well and in the same position as that shown in Fig. 1, but with the reaming-bits spread apart. This position is likewise at right angles to that shown in Figs. 2 and 5. The spring is shown in section, and one side of the connection-rod clevis and a section of the leg are broken away. Fig. 4 is a bottom view of the tool as shown in Fig. 3. Fig. 5 is a side elevation of the tool partly in section, in a plane parallel to Fig. 2 and at right angles to Figs. 1 and 3. Fig. 6 is an enlarged view partly in section, of the upper piece of the connecting-rod. Fig. 7 is an enlarged view of the lower piece of the connecting-rod. Fig. 8 is an enlarged view of the latch. Fig. 9 is an enlarged view of a larger mandrel than that shown in Figs. 1, 3 and 5, whose use will be explained hereinafter.

My invention relates to that class of Artesian and oil well drilling-tools known as "well enlarging tools," which are used for increasing the diameter of the well hole, below the bottom of the casing.

In the process of drilling oil-wells, what is termed a "large hole," is started at the top of the well and drilled down to a point below the fresh-water courses. A casing of iron pipe is then put down to the bottom of this hole and made water-tight, and the drilling is then resumed, with drilling-bits narrower than the inside diameter of the casing through which the tools pass freely. The depth of these water-courses vary in different localities, so that the driller has to rely on his own

judgment as to the amount of the casing needed in the well to shut off the said water-courses. He may believe the well hole to be below all of the fresh water courses, insert the casing in the well, and proceed with the drilling for some depth below the casing and then open other water veins. The usual method in such cases is to, withdraw all the casing, extend the large hole past these lower water veins by reaming, and then recase the well. This is not only objectionable but expensive. Moreover a strata of soft rock may be encountered, which if the casing be withdrawn caves in on the tools, and by continued drilling in said strata there is great danger of the tools becoming buried and the hole plugged.

The object of my invention is to obviate the necessity of withdrawing the casing from the well when it becomes necessary to deepen the large hole. This I accomplished by providing a tool that will pass down through the casing and expand so as to enlarge the well hole below the casing to such a diameter as to allow the casing to be lowered to the desired depth by adding lengths or joints to its upper end. This is particularly essential in a well where the rock caves in, as the casing can be kept at such a distance above the bottom of the well as to allow the enlarging under reamer to work freely and at the same time protect the balance of tools from the caving rock, the casing being lowered as the hole increases in depth.

Referring to the drawings:—A is a screw-threaded pin for connecting my enlarging under reamer to the drilling-tools.

B, is a collar, C, is the shank, and D and E, are the legs provided with the segmental reaming-bits F.

Secured to the reaming-bits F, by means of the bolts G are slotted plates H. The object of these slotted plates H is to prevent the reaming-bits F from spreading more than the required distance apart when in use.

J, is a rod provided at its lower end with the mandrel J', the object of which is to separate the reaming-bits F and hold them the required distance apart when they are reaming the hole in the well P, and said rod J is provided at its upper end with the clevis J².

K is a telescoping connecting-rod composed of two pieces, the upper one of which is pro-

vided with the clevis K' for the purpose of connecting it to the shank C, by means of the bolt K². The clevis K' is fitted in the depression C'. The upper part of rod K is also provided with the socket K³ in which the reduced part K⁴ of the lower piece of the connecting-rod K works. This lower piece is also provided with the clevis K⁵ (see Fig. 6) which engages the correspondingly formed end of mandrel rod J. Surrounding the connecting-rod K is a spiral spring N, whose ends bear against the collars K⁶ and K⁷ formed on the respective parts of rod K.

L is a latch provided with perforations L' and L² and the projecting end L³. This latch L is inserted in the slot E' of the leg E on the side of the leg E where it is secured by a bolt or rivet E² passing through the hole L' of latch L and the sides of said slot E'. The latch is thus movably secured to leg E. The other extremity of the latch L, fits in between the wings of the clevis K⁵ which latter is fitted between the wings of the clevis J². The latch and both clevises are pivotally secured by the rivet M, so as to form a knuckle or toggle joint between the rods J and K, which is actuated by the latch L.

The method of operating my improved "enlarging under reamer" is as follows:—After screwing the shank into the box of the auger-stem, the drilling-tools are lowered into the casing, the latch L having been pushed down into the slot E' of the leg E, the parts of rod K forced together and the mandrel J' raised from between the reaming-bits F, allowing the latter to be pressed together for entering the casing O. In this position the enlarging under reamer, can pass freely down in the casing as shown in Fig. 2. As soon as the enlarging under reamer passes below the bottom of the casing O, (see Fig. 3) the flaring edges of the reaming-bits F start to cut a shoulder in the wall of the well P. The latch L being now below and free from the casing O, it drops to its lowest position in the slot E' actuated by the spring N. This movement forces the mandrel J' down into the recess E³ between the reaming-bits F and the expansive power of the spring N, will hold it there, preventing the reaming-bits F from being pressed together when working on the walls of the well hole P. When it is desired to remove the enlarging under reamer from the well, the tools are hoisted in the usual manner. As soon as the projecting end L³ of the latch L, reaches the bottom of the casing O it is caught thereon and tripped, with the

effect of forcing it into slot E', compressing the spring N and raising the mandrel J' out of the recess E³ between the reaming-bits F, so that the casing O may press the reaming-bits F together and permit them to pass through as shown in Fig. 1. When the well has been reamed to the desired depth the casing can either be elevated high enough to allow the enlarging tool to cut off the shoulder on which it stands, or if the rock is soft a few blows on top of the casing, will cause the shoulder to break off and the casing will pass through. It will be perceived that there are two angular steps Q and R on the inside of each reaming bit F, and in the space between these is the recess S, formed for the mandrel J', to rest in when not engaged with the reaming bits E. By continued use of the tool, the reaming-bits F will wear, and the frequent dressings consequent thereof, will shorten them up, say to the dotted lines T. In such cases the rod J and mandrel J' are replaced by a similar rod U and mandrel V (see Fig. 9) said mandrel being made large enough to spread the reaming-bits E the desired distance apart when inserted in the recess S and when the mandrel V is raised out of the recess S and the tool assumes the position shown in Fig. 1, it will rest on the steps Q. The additional rod U which is provided with a clevis similar to J² and the mandrel V, is furnished with and considered a part of the outfit.

Having thus described my invention, what I claim is—

1. In a reamer for wells, the combination of the expansible bit, a mandrel for expanding said bit, suitable means for projecting the mandrel consisting of the toggle bars, one of said bars being composed of the telescoping sections and having a spiral spring surrounding said sections for forcing them apart, substantially as explained.

2. In a reamer for wells, the combination of the expansible bit, the mandrel for expanding said bit, a plate for limiting the movement of said bit, toggle bars for projecting the mandrel, one of said bars being composed of the telescoping sections, a spiral spring surrounding said sections for forcing them apart, and a trigger for controlling said toggle bars, substantially as set forth.

PATRICK H. MACK.

Witnesses:

BEN R. HAGAR,
E. C. HEATHCOTE.

**Defendant's Exhibit U. S. Patent to Palm No.
563,054.**

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Patent to Palm No. 563,054.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Patent to Palm No. 563,054. Filed May 8, 1917. F. D. Monckton, Clerk.

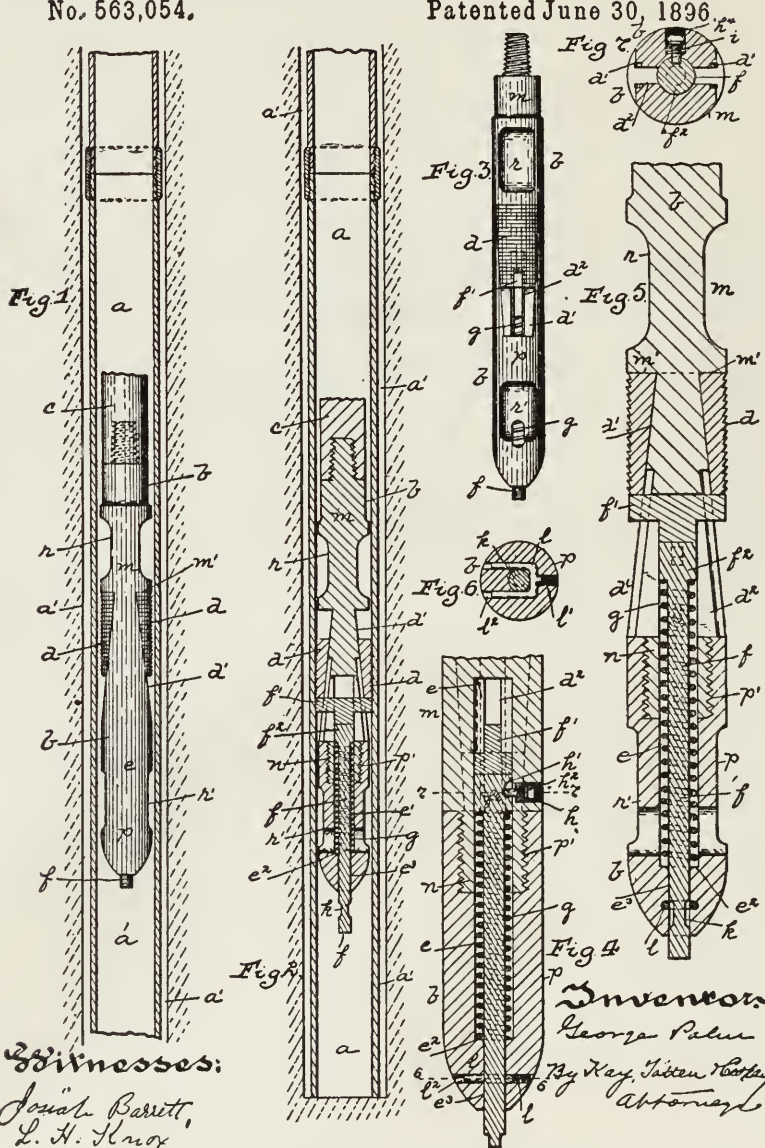
(No Model.)

G. PALM.

APPARATUS FOR JARRING CASINGS IN ARTESIAN WELLS.

No. 563,054.

Patented June 30, 1896.



UNITED STATES PATENT OFFICE.

GEORGE PALM, OF BUTLER, PENNSYLVANIA.

APPARATUS FOR JARRING CASINGS IN ARTESIAN WELLS.

SPECIFICATION forming part of Letters Patent No. 563,054, dated June 30, 1896.

Application filed February 3, 1894. Serial No. 498,998. (No model.)

to whom it may concern:

Be it known that I, GEORGE PALM, a resident of Butler, in the county of Butler and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Jarring Casings in Artesian Wells; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for jarring casings in Artesian wells, its object being to provide apparatus for loosening the casing, and, if necessary, lifting the same, such apparatus can easily be lowered into the casing and then caused to engage with the interior face thereof and to hold firmly the same while the tools are jarred upwardly until the casing is loosened from the surrounding body of broken and powdered rock holding the same within the well, and then, after the loosening of the casing, to provide for the withdrawal of the engaging devices or jaws from the wall, so that the apparatus may be withdrawn from the well.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a well, showing the apparatus therein in full lines. Fig. 2 is a like view showing the apparatus in section and also showing it engaging with the tubing—that is, in the jarring position. Fig. 3 is a side view of the tool at right angles to Fig. 1. Fig. 4 is an enlarged sectional view of the lower portion of the tool, illustrating the same in position for withdrawal from the well. Fig. 5 is an enlarged sectional view of the tool, showing the parts in the position in which they are withdrawn from the well. Fig. 6 is a cross-section on the line 6 6, Fig. 4; and Fig. 7 is a cross-section on the line 7 7, Fig. 4.

Like letters of reference indicate like parts in each view.

In the drawings, *a* represents the tubing within the well *a'*, and *b* is the jarring-tool which is connected by a threaded joint with the lower end of the string of tools within the well, such as with the lower end of the drill-rod, as at *c*. The tool *b* has the inclined faces *d'* over which the jaws *d* move, as is

more particularly shown in the section Fig. 7, the jaws being held to the inclines of the tool-body by means of dovetails or like sliding connections, so that they can slide down the inclines and engage with the interior of the tubing or casing *a*. It will be noticed that the jaws have biting-faces, the inclines of the teeth of which extend upwardly, so that they will take into the tubing as the tool is raised, and consequently will act to give a strong hold of the tool upon the tubing when the tool is drawn upwardly, but will have no biting action as the tool is lowered. Below the inclines *d'* of the tool is the annular portion *e*, which incloses the spring-operated bar or support *f* within the central bore *e'* thereof, this spring-operated bar carrying at the upper end thereof the cross-head *f'*, which extends out through longitudinal slots *d²*, extending from the central bore of the tool through the inclines *d'* of the tool, so that the cross-head *f'* may engage with and hold up the jaws *d*. The bar *f* has the enlarged upper end *f²* fitting within the central bore and centering the bar therein, and the central bore is reduced at the lower end so as to fit around the main body of the bar. Surrounding the bar *f*, within the central bore *e'*, fitting against the shoulder *e²* at the top of the reduced portion *e³* of the central bore, and pressing against the enlargement *f²* of the bar is the spring *g*, which acts to raise the bar *f* and through its cross-head *f'* raise the jaws *d*. Two operations are required for this bar, one that it shall be held down and the spring *g* compressed when the tool is lowered within the well, so leaving the jaws *d* free to slide on the inclined faces *d'* and engage with the casing, and the other that when the tool is being withdrawn from the well after its function of jarring the tubing or casing loose has been accomplished the spring *g* shall operate to raise the bar and hold up the jaws, so that contact of the jaws with the inner wall of the casing is prevented. For this purpose I employ two latches or spring-locks. The upper spring-latch *h* engages with a seat *h'* of the bar above the spring, the latch *h* in its normal position being withdrawn so that it does not engage with the bar, and for that purpose a spring *i*, fit-

ting around the latch within the seat h^2 thereof in the body of the tool and pressing against a head on the latch so as to withdraw it from the course of the bar, a suitable opening h^3 being formed in the cap or plate h^4 , which holds the latch in place, so that by any suitable tool the latch h can be forced inwardly to engage with the seat h' in the bar, and before the tool is lowered into the well, by means of the cross-head f' , the bar f is forced downwardly until the seat h' is in line with the latch h , and the latch h is then pressed inwardly into the seat h' , when the force of the spring g pressing against the latch-head holds it in the seat, and so holds the bar f down away from the jaws d . Near the lower end of the bar f is the seat k , and, as shown in Fig. 6, in the lower part of the tool is the spring-latch l , which is forced inwardly toward the bar by the spring l' , this spring-latch being preferably of the form shown in Fig. 6, that is, of forked shape, so that it extends on each side of the bar, and fits in seats l^2 provided therefor, the ends of the latch extending through the body of the tool, so that in forcing the bar f downwardly the spring-latch l may be forced out of its way so as to permit the shoulder k' on the bar f above the seat k to pass the spring-latch or stop l , it being shown in that position in Fig. 4. The upper end of the seat k is inclined so as to force the spring-latch l out of the way, and, as a result, when the bar is freed from the upper spring-latch h , it will be raised by the spring g and pass the spring-latch l , which then secures the bar in its raised position.

The body of the tool is preferably made in sections, the upper section m having the inclines d , and above the inclines the shoulders m' to limit the upward movement of the jaws d , and below the inclines the threaded extension n , which engages with a threaded socket p' in the lower section p , so providing for the screwing of the parts together and the insertion of the bar f within the socket or central bore e' of the tool. The two sections have any suitable angular or like places to provide for the screwing up, such as the angular portion r on the upper section m and the angular portion r' on the lower section p .

The operation of the tool is practically as follows: The tool is secured at the end of the string of tools, generally hanging below the drill-jars, being suspended above the same by the ordinary drilling-rope connected to the walking-beam. The operator forces down the bar f , drawing aside the latch l to let it pass downwardly, and lowering the bar until its seat h' comes in line with the upper latch h , when that latch is forced inwardly into the seat h' , and the pressure of the spring g against the latch holds it in place, and so holds the bar f in the position shown in Fig. 4 with the spring g compressed. He then lowers the tools into the well until the jar-

ring-tool reaches the desired position, the jaws sliding along the interior wall of the casing, but not holding thereto, as the incline of the teeth thereon is in an upward direction. When the tool reaches the desired position, the jaws d will of course slide down their inclines and bear against the casing. He then, through the walking-beam, gives upward jars to the tool, drawing the jaws upwardly by means of the walking-beam, so that they engage with the inner wall of the casing sufficiently to hold against dropping, and he lowers the walking-beam, so as to close the drill-jars, and raises it again, so as to give the upward jar and so force the jaws d into the tubing and cause them to hold fast thereto. He continues this upward-jarring action after the jaws of the tool have grasped the tubing, and by means of such upward-jarring action, through the jaws holding to the tubing, imparts an upward jar to the tubing, continuing this until he has jarred the tubing loose. In so doing, as the jaws d slide down the inclines d' they will strike against the cross-head f' of the spring-operated bar f and will compass the same, and as a result will overcome the pressure of the spring g , operating through the bar f , upon the upper latch h , leaving that latch free to be withdrawn by its spring g , and therefore leaving the bar f free to rise within the tool and to follow up the movement of the jaws d . As soon as the tubing is jarred loose and the operation of loosening the same is completed, in order to withdraw the tool it is necessary to release the jaws from engagement with the tubing, and the operator then changes the movement and, through the drilljars, imparts a downward jar to the tool, which forces the tool-body downwardly between the jaws d , holding to the casing, and, through the dovetail or like connections of the jaws with the tool, withdraws the jaws, and as soon as the jaws are thus withdrawn the spring-bar f , through its cross-head f' , raises the jaws d until they strike against the shoulder m and holds them in such raised position. As the spring-bar passes upwardly the lower end thereof is drawn up therewith until the seat k comes in line with the spring-latch l , when that spring-latch engages with the seat and holds it in its raised position, so forming a positive means for holding the jaws in their raised position, as shown in Fig. 5, so that as the tool is raised from the well, even if the teeth of the jaws should contact with the interior wall of the tubing, they cannot obtain any firm hold therein. The tool is then ready to be raised and can be drawn from the well.

The tool is thus made practically automatic in its operation when within the well, both to permit the engagement of the jaws with and the firm holding of the jaws to the tubing to be jarred, and, when that jarring operation is completed, to free the jaws and to raise them into such position that they can-

563,054

3

engage with the tubing, an efficient tool is purpose being therefore provided.

What I claim as my invention, and desire secure by Letters Patent, is—

In jarring-tools for tubing, the combination of the tool-body having a single pair of inclined surfaces *d'*, the jaws *d*, the bar *f*, the cross-head *f'* adapted to engage with said jaws *d*, said cross-head working in the slots in the tool-body, the spring *g*, a latch for

holding said cross-bar out of the way of said jaws, the spring-latch *l*, said bar *f* having the seat *k*, substantially as set forth.

In testimony whereof I, the said GEORGE PALM, have hereunto set my hand.

GEORGE PALM.

Witnesses:

J. N. COOKE,

L. H. KNOX.

**Defendant's Exhibit U. S. Mentry Patent No.
647,605.**

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Mentry Patent No. 647,605.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

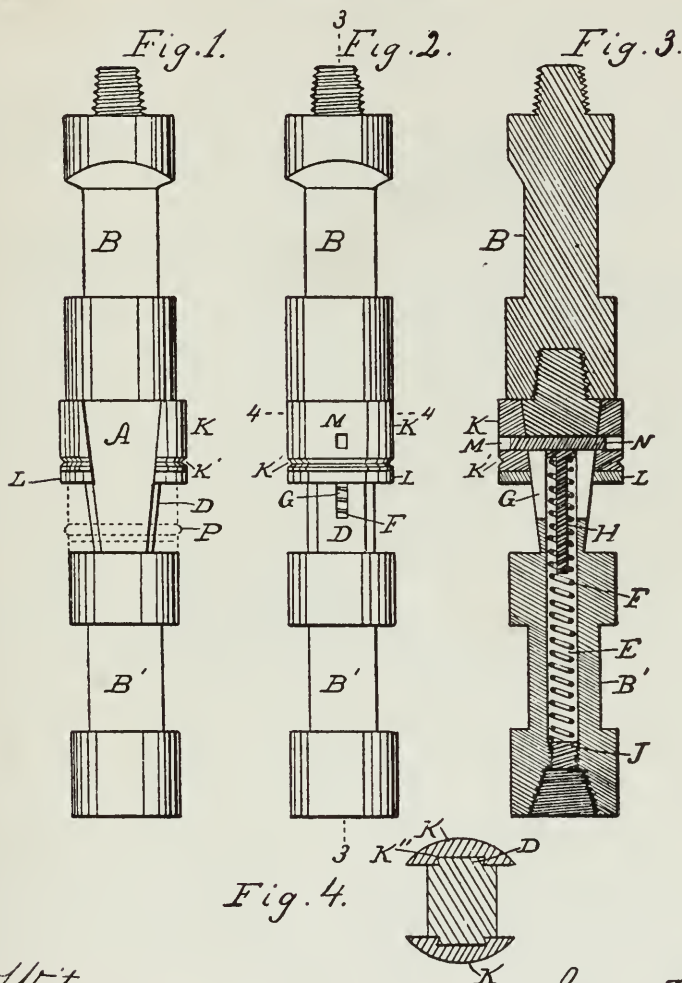
No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Mentry Patent No. 647,605. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 647,605.

Patented Apr. 17, 1900.

C. A. MENTRY.
EXPANSION REAMER.
(Application filed Mar. 16, 1899.)

(No Model.)



Witnesses
M. M. Ginn
S. L. Benjamin

Inventor
Charles A. Mentry
By Hazard & Harpham
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES A. MENTRY, OF NEWHALL, CALIFORNIA.

EXPANSION-REAMER.

SPECIFICATION forming part of Letters Patent No. 647,605, dated April 17, 1900.

Application filed March 16, 1899. Serial No. 709,351. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. MENTRY, a citizen of the United States, residing at Newhall, in the county of Los Angeles, State of California, have invented a new and useful Expansion-Reamer, of which the following is a specification.

My invention relates to improvements in reamers for enlarging a well-hole; and the objects of my improvement are, first, to provide a reamer that will enlarge the well-hole below the casing when necessary, and, second, to provide a reamer which will straighten the hole in case the drill gets the hole out of perpendicular. I attain these objects by the mechanism described herein and illustrated in the accompanying drawings, in which—

Figures 1 and 2 are side views of my reamer and the shank thereof, the plane of one view being at right angles to that of the other. Fig. 3 is a central longitudinal section taken on line 3 3 of Fig. 2. Fig. 4 is a cross-section taken on line 4 4 of Fig. 2.

A is the reamer, and B is the shank thereof. They are preferably square in their centers, affording bearings for holding a wrench when being screwed together or taken apart. The frame B' of the reamer is provided with two inclined guide-lugs D, located on opposite sides thereof. These lugs are adapted to fit into the dovetailed grooves K" in the cutter-head K. In the reamer-frame B' is a central cylindrical opening E for the reception of the spiral spring F. This opening extends from the bottom of the reamer to the slot M at the top thereof. It forms a housing for the spiral spring F. Dropping into this spring, at the top end thereof, is the spring-actuated pin H, the head of which rests on the upper end of the spring and forms a bearing for the upper end of the spring. This pin will keep the spring in proper alinement and prevent it from collapsing when depressed. The head of this pin will at all times be spring-pressed against the square pin N, keeping it in its normal or elevated position. This pin N forms a connection between the cutters K, mounted on either side of the reamer, into one of which the pin is tightly driven and rigidly held, and in the other it has a working fit. This will permit the two halves of the cutter-head on opposite sides of the frame to ap-

proach and recede one from the other as they move up or down in the inclined guideways. This pin passes through the transverse longitudinal slot G and has a vertical movement therein.

J is a screw-threaded plug screwed into the bottom of the opening E and forms the bottom bearing for spiral spring F.

K are semicircular cutter-heads located one on each side of the reamer-frame and provided with dovetail grooves K" to receive the dovetail guide-lugs D, on which they have a vertical movement. These cutter-heads are provided with cutting-plates L, lying beneath the cutter-heads and detachably affixed thereto in any suitable manner. The cutter-heads are preferably made of iron and the cutter-plates of steel, so that the cutter-plates can be taken off, tempered and sharpened, or renewed, as the wear comes principally on the bottom.

Instead of the two cutter-heads one may be used, in which case the inclined guide-lug (upon which it work vertically) should be, made larger and stronger. The cutter-head has formed in its outer side a groove K' to receive a wire or cord P (shown in dotted lines in Fig. 1) to bind and hold the cutters in their lowest and contracted position, which position they must be in when the reamer is being lowered through the pipe into the hole. This wire will be broken as soon as the bit strikes the bottom or when the cutter strikes any obstacle in the well, releasing the cutter-head and permitting the spring F to force the cutters upward into their elevated and expanded position, as shown in full lines in the drawings, its depressed or contracted position while tied being shown in dotted lines in Fig. 1.

It will be observed that the extent to which the reamer will enlarge a hole depends on the distance one from the other of the inclined guide-lugs D at the upper end thereof. The distance of said lugs one from the other at their extreme lower end should be such that when the cutters are at their lowest position there is a clearance-room in the pipe between the outside of the cutter-head and the inner wall of the pipe for the passage therethrough of the cutter-head. The lugs could be made separate from the frame and fastened thereto

by screws or bolts; but I prefer to make the lugs integral with the frame. The cutters in their normal elevated position will project outside of the outer line of the casing or pipe and can be withdrawn from the well only when in their lower or contracted position, which position they are crowded into as they are drawn up against the bottom of the casing in being drawn from the well.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described expansion-reamer, comprising the frame B' provided with inclined guide-lugs D on either side thereof, transverse longitudinal slot G providing clearance-way for the pin N in its vertical movement, and provided also with longitudinal slot E for receiving the spiral spring F; spiral spring F in the slot E; spring-actuated pin H in said spring and depending from the top thereof; plug J screwed into the bottom of slot E forming the bottom bearings for said spring; cutter-heads K having groove K" adapted to fit on the inclined guide-lugs D; transverse slot M for the reception of the connecting-pin N; the connecting-pin N adapted to fit firmly into the slot M in one cutter-head and have a working fit in the slot in the other cutter-head; detachable cutter-plates L below the cutter-head; the said reamer being provided with means at the top for its attachment to the shank, and means for attaching a drilling-bit at the bottom, substantially as described.

2. The combination in an expansion-reamer with the frame B' provided with inclined dovetailed guideways D and having a central longitudinal slot E for the reception of the spiral spring F and a transverse longitudinal slot G at the top of the slot E, of the spiral spring F in slot E and adapted to support the pin H, the head of which forms the upper bearing for said spring; the spring-actuated pin H below the connecting-pin N and arranged to exert an upward impulse thereto; the connecting-pin N, one end being tightly held in one cutter-head and having a working fit in the other cutting-head; the cutter-heads K provided with grooves K" to fit on the guide-lugs D, opening M for the connecting-pin N, and also with wire-receiving grooves K' in the exterior thereof; binding-wire P adapted to fit into groove K' and hold the cutter-heads in their depressed and contracted position; 55 cutter-plate L beneath the cutter-heads and detachably affixed thereto; plug J screwed into the bottom of the slot E and forming the bottom bearing for the spiral spring F; and binding-wire P adapted to hold the cutter-heads in their depressed and contracted position, substantially as shown and described.

I witness that I claim the foregoing I have hereunto subscribed my name this 8th day of March, 1899, at Los Angeles, California.

CHARLES A. MENTRY.

Witnesses:

G. E. HARPHAM,
M. MCGINNIS.

**Defendant's Exhibit U. S. Sullivan Patent No.
79,276.**

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Sullivan Patent No. 79,276.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

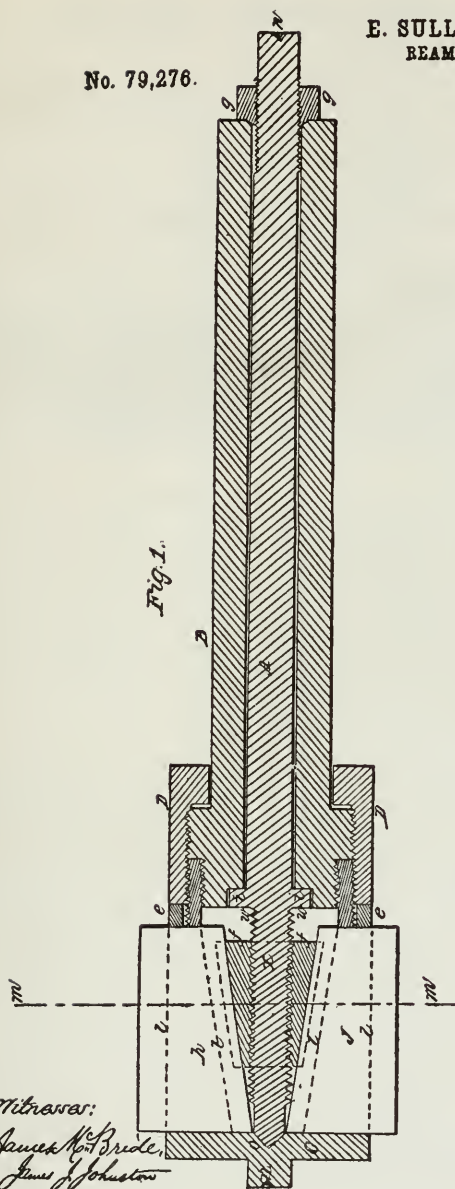
No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Sullivan Patent No. 79,276. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 79,276.

E. SULLIVAN.
BEAMER.

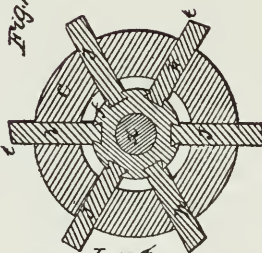
Patented June 23, 1868.

Fig. 1.



Witness:
James M. Bredt,
James Johnston

Fig. 2.



Inventor:
Edward Sullivan

UNITED STATES PATENT OFFICE.

EDWARD SULLIVAN, OF PITTSBURG, PENNSYLVANIA.

Letters Patent No. 79,276, dated June 23, 1868; antedated June 6, 1868.

IMPROVEMENT IN REAMERS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, EDWARD SULLIVAN, of Pittsburg, in the county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in "Graduating-Reamers;" and I do hereby declare the following to be a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in the combination and arrangement of a number of parts, the whole making a reamer, the cutters of which can be graduated so as to bore holes of different diameters, and operating in the manner hereinafter described.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

In the accompanying drawings, making part of this specification—

Figure 1 is a longitudinal section of my improved reamers.

Figure 2 is a transverse section of the same, cut through line *m*, fig. 1.

In fig. 1, B represents a hollow shank, upon one end of which are formed two screw-threads, one of which is to receive the cutter-head C and the other to receive the sleeve D. *h* are the cutters, and J are the wooden blanks. A is a rod or stem placed within the shank B, and furnished at one end with the screw-thread *x*, to receive the cone *f*, and at the other end with a square head to receive a wrench, and with the screw-thread and nut *g*. *f* is a conical-shaped piece, for the purpose of holding the cutters and blanks. C is the cutter-head, through which the cutters and blanks project. *e* is a collar, and D is a sleeve for the purpose of holding the collar *e* up against the ends of the cutters and blanks.

The manner in which I construct my reamer is as follows:

I make the shank B of cast iron, and either core or bore the hole through it to receive the rod A. Upon one end of the shank B are formed the screw-threads to receive the cutter-head C and sleeve D. The cutter-head I also make of cast iron, hollow, as shown by the dotted lines *l*, and with slots or mortises, which extend out through one end of the head to receive the cutters *h* and blanks J. Upon the open end of the cutter-head C, I form two screw-threads, one male and one female; the female to receive the end of the shank B, and the male to meet the male screw-thread on the shank B; and to receive the sleeve D, the collar *e* is made large enough inside to pass over the outside of the above-mentioned male-screw threads, intended to receive the sleeve D, which is made of cast iron, the collar *e* of wrought iron. The rod A and nut *g*, I make of wrought iron or steel, and terminate one end of the rod in a conical shape, which fits into the recess in the cutter-head C, as shown at the point marked *o*, for the purpose of keeping the rod in the centre of the reamer, and steadying the cutters. Upon the rod, at the point marked *w*, I form a collar, *i*, which fits into a recess in the end of the shank B, the use of said collar, when used in connection with the nut *g*, being to fasten the rod A when the cutters are set to the required position. The cone *f*, I make of wrong iron or steel, and on the inside of the hole, which passes through the centre of it, I form the screw-thread to receive the screw-thread *x* on the rod A, and upon its outside surface I form the dove-tail grooves to receive the cutters and blanks, which are fitted neatly into it, but with sufficient play to allow the cone to be moved back and forth by the rod A, for the purpose of regulating the cutters and blanks. The cutters I make of steel, and the blanks of hard wood, such as hickory or locust, and after fitting them into the cone and cutter-head, and putting all parts of the reamer together, I put the reamer into the turning lathe, upon the centres marked *n*, and dress them off true. I now file off the back of the cutters, as shown at the points marked *t*, so as to give them a cutting-edge. The blanks I leave as they come from the lathe, their purpose being to steady the reamer in the work.

The reamer is now finished and ready for operation, which is as follows:

Having the diameter given to which it is required to bore a hole, I unscrew the nut *g* upon the rod *A* and the sleeve *D* upon the shank *B*, and placing a wrench on the end of the rod, I turn said rod in the proper direction, and move the cone *f*, which moves the cutters *h* and blanks *J* to the required size. I now tighten the nut *g* upon the rod *A*, which draws the collars *i* up against the end of the shank *B*, and thereby prevent the rod *A* from becoming disarranged and moving the cutters and blanks. I now tighten up the sleeve *D* against the collar *e*, which comes against the cutters and blanks, which comes against the cutter-head *C*, and by this means bind the cutters and blanks firmly in their place.

The reamer is now ready for use, and is applied to the work in the same manner as the ordinary reamer and "rose-bit," the application of which is well known to the skillful workman, and therefore not necessary to be described.

I wish it understood I do not confine myself to any particular size or proportion, or the kind of material used in the construction of my improved reamer, for the same may be varied to suit the judgment of the mechanic making and using it, and the same general result obtained.

Having thus described the nature, construction, and operation of my improvement, what I claim as of my invention, is—

The combination and arrangement of the cutters and blank-head *C*, collar *e*, sleeve *D*, cone *f*, rod *A*, and the cutters and blanks, the whole being constructed, arranged, combined, and operating substantially as herein described and for the purpose set forth.

EDWARD SULLIVAN.

Witnesses:

JAMES J. JOHNSTON,
JAMES MCBRIDE.

Defendant's Exhibit U. S. Lloyd Patent No. 344,744.

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Lloyd Patent 344,744.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Lloyd Patent No. 344,744. Filed May 8, 1917. F. D. Monckton, Clerk.

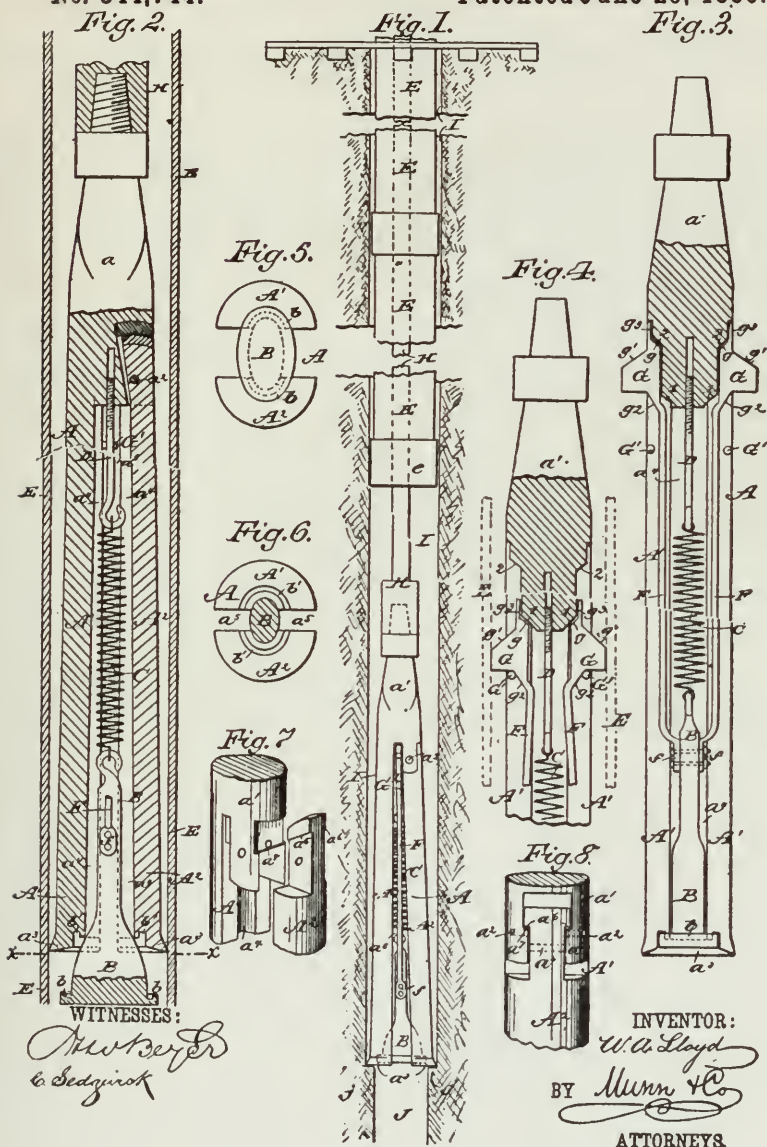
(No Model.)

W. A. LLOYD.

REAMING TOOL FOR USE IN SINKING BORED WELL CASINGS.

No. 344,744.

Patented June 29, 1886.



UNITED STATES PATENT OFFICE.

WILLIAM ALEXANDER LLOYD, OF MACKSBURG, OHIO.

REAMING-TOOL FOR USE IN SINKING BORED-WELL CASINGS.

SPECIFICATION forming part of Letters Patent No. 344,744, dated June 29, 1886.

Application filed October 5, 1885. Serial No. 179,031. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ALEXANDER LLOYD, of Macksburg, in the county of Washington and State of Ohio, have invented a new and Improved Reaming-Tool for Use in Sink-

ing Bored-Well Casings, of which the following is a full, clear, and exact description.

My invention relates to reaming-tools adapted to ream out bores made in the earth by solid drills or tools passed through the inside of the partly-sunk casings of oil or Artesian wells, and so that said bores may be enlarged to the full exterior diameter of the casings, to allow the latter to be sunk as the boring proceeds.

The object of the invention is to facilitate this work by providing a simple, readily-adjustable, and effective expansible tool of improved construction, by using which the well-casing may be sunk to shut out surface or drainage water without allowing the earth to cave in, and permitting a boring and casing of the well at a considerable saving of time and labor over other means of performing the work.

The invention consists in certain novel features of construction and combination of parts of the reaming-tool, all as hereinafter fully described and claimed.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a central vertical section of a bored well with the casing applied and partly broken away, and shows also in side elevation my improved reaming-tool as at work in the well. Fig. 2 is a vertical sectional elevation of the reaming-tool in larger size and showing it in its contracted condition, as when passing through the well-casing, which latter is shown in section. Fig. 3 is a sectional elevation of the reaming-tool taken at right angles to Fig. 2, and showing the tool-expanding head raised to expand the cutters, as when the tool is in use. Fig. 4 is a sectional elevation of the upper part of the reaming-tool and shows the adjustment of the expander-catches when the reaming-tool is contracted to pass through the well-casing, which is shown in dotted lines.

Fig. 5 is a view of the lower or cutting end of the tool when expanded for use. Fig. 6 is a view of the cutting end of the tool when contracted, and shows the expander-head in section on the line $x\ x$, Fig. 2; and Figs. 7 and 8 are detail views of the joint of the hinged jaw with the head of the tool.

The letter A indicates the reaming-tool, the body of which is formed in two main parts, the part of jaw A', with which the head a' of the tool is formed, and the jaw A², which is pivoted on a pin, a^2 , to the head of the tool, and so as to swing toward and from the jaw A', to contract and expand the tool at its lower end, and the upper end of the jaw A² will preferably be fitted with a steel cap-plate to work on a steel facing-plate set into the head of the tool, and as indicated by the darkly-shaded section lines in Fig. 2. The lower ends of both jaws are dressed so as to provide the cutting-lip a^3 on each jaw, and the lips are undercut at their outer faces for more effective action of the cutters. The upper extremity of the jaw A² is provided with shoulders a^6 , which incline downward and inward, and are adapted to catch upon correspondingly-inclined shoulders a^7 , formed in the tool-head a' , if the pivot-pin a^2 and the spring (hereinafter mentioned) should break, and thus prevent loss of the jaw A² down the hole, and as will be understood from Figs. 7 and 8, the pin a^2 , being shown broken and the shoulders $a^6\ a^7$ in contact in Fig. 8. The downward and inward incline of the shoulders prevents easy slip of the head of the jaw A from the socket made for it in the tool-head a' . The inner faces of the jaws A² of the tool are recessed longitudinally, as at a^4 , and separated, as at a^5 , to give space for the expander, which is made with a head or block, B, tapered backward from its outer end and connected at its inner end to one end of a spring, C, the inner end of which is connected to the head a' of the tool, and preferably by attaching the spring to a screw eye or bolt, D, which is threaded into a hole in the head, so that the screw may be turned in or out to regulate the tension of the spring, the normal action of which is to draw the tapering head B upward between the opposite jaws A' A² of the tool, to throw the jaw A² outward

344,744

r expanding the tool. The tapered sides of e head B, which face the jaws A' A², (see g. 2,) are formed with upward-projecting as b b', which lock into grooves b' b', formed at the ends of the jaws A' A², when the spring draws the head B fully upward, at which time the bottom face of the head stands above the sharp outer edges of the cutting-lips of the jaws, so as not to interfere with their effective cutting action. (See Figs. 1 and 3.) By the interlocking of the head B with the jaws A' at b b' the jaws will be held against further expansion, so as to cut the hole for the well-casing E to a uniform diameter.

Instead of the lips b, the head B may have half-dovetailed flanges, as indicated by the dotted lines in Fig. 2, and which will enter correspondingly-shaped recesses in the ends of the jaws A' A², and will have the same effect. It will be noticed that the tension of the spring C will hold the jaw A² up into its socket if the pivot-pin a² should break.

To opposite sides of the top of the expanding-head B are fixed at f f' the elastic or spring metal rods F, F, which lie in the space a between the jaws A' A² of the tool, and at their upper ends are provided with the heads or catches G G, which have the inclined faces or shoulders g g, which are adapted to lock under opposite lower shoulders, l l, formed at the lower end of the head a' of the tool, as in Fig. 4, when the tool is contracted, and are adapted also to lock under opposite upper shoulders, 2 2, as in Fig. 3, when the tool is expanded. The upper edges of the catches G are beveled downward and outward, as at g', to force the catches and the expanding-head B to be lowered, and the catches to be forced inward, when the catches are brought against the lower end or shoe e of the casing E in withdrawing the reaming-tool from the casing.

The letters G' G' indicate pins or studs, which are fixed to the inner face of the tool-jaw A' in such positions that inclined faces g² of the opposite expander-catches, G G, will strike said pins and automatically force the catches inward, so as to lock their shoulders g' under the shoulders l l of the tool-head a' to allow the tool to contract. It is obvious that these pins G' G' also will form rests for the catches G G should the expander-spring C or its connection D break, and thus will prevent loss of the expander down the hole when the tool is in use. Stems g³, on the upper ends of the catches G, form stops for the catches against shoulders on the head of the tool.

The letter H indicates the boring-bar, to be connected with the head a' of the reaming-tool A is to be connected. The letter I indicates the full-size bore of the well, and the letter J indicates the smaller bore of the well, which is made by a drill entered through the casing E, and which bar J is to be enlarged or reamed out by the reaming-tool A, to allow the casing to be lowered into the bore of the well.

The operation is as follows: The well-bore

I will be made by suitable drills to any depth from the ground-surface to which it may be sunk without danger of the caving in of its side walls, which depth will vary with the nature of the strata of earth through which the drill passes, and the drill will be withdrawn, and the casing E will be lowered in jointed lengths, as usual, until within about ten feet of the bottom of the well-bore I, so as to give room for the operation of the reaming-tool A, which is about five feet long. As large a drill as may safely be passed through the inserted well-casing E, then will be fixed to the bar H and lowered through the casing to the bottom of the bore I, and will bore a hole, as at J, too small to admit the pipe E, and for as great a depth as permissible, without allowing the earth to cave in. This drill then will be withdrawn, and the reaming-tool A will be fixed to the boring-bar, and the expanding-head B will be forced outward by pressure on the catches G of the rods F, or otherwise, until the catch-shoulders g pass below or against the shoulders l of the head a' of the tool A, and so as to allow the jaw A² to be swung inward to contract the tool and at the same time admit the catches G within the casing, and so that the entire tool A may be passed downward through the casing. When the catches G pass below the shoe e of the casing, they will be pressed outward by the tension of the spring C as the expander-head B is drawn upward by the spring to expand the reaming-tool to the full diameter of the well-bore I, and the shoulders g of the catches G will rest on the shoulders 2 of the head a' of the tool as the lips b of the head B lock into the grooves b' of the tool-jaws A' A², to hold them expanded. The reaming-tool now will be operated by the boring-bar to cut away the side walls, of the bore J to the full size of the bore I for a safe depth, and the tool A then will be lifted by the boring-bar in the bore I, and the inclined ends or faces g' of the catches G will strike the end of the shoe e and force the catches and the retainer-head B downward, as in Figs. 2 and 4, so that the reaming-tool A may contract, so as to be drawn upward through the casing E. The casing now will be lowered again to within about ten feet of the bottom of the bore I, as before, and the boring at J will be resumed and the drill withdrawn, and the reaming-tool A will again be passed through the casing to enlarge the bore J, and the casing will again be forced downward, as before, and so on by successive stages will the casing be sunk into the earth, and without allowing the earth to cave in, so that the well may be bored and cased with economy of time and labor over other methods of performing the work, as there is little or no danger of losing the tools in the bores when the earth is prevented from caving in onto them.

It is evident that the shoulders 2 2 of the head a' of the tool are not essential to the suc-

cessful operation of the reaming-tool, as the locking of the lips *b* of the head B with the ends of the jaws A' A' will be a sufficient stop to limit the rise of the catches G as the expander is drawn upward by the spring C; but the use of the stop-shoulders 2 2 is preferred.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

10 1. The reaming-tool A, constructed with a fixed jaw, A', and a pivoted jaw, A², with ends formed as cutters and provided with shoulders 1 1 at its head *a'*, and an expander consisting of a tapering head or block, B, placed between the jaws A' A², a spring, as at C, tending to draw the head inward for expanding the tool, and catches, as at F G, fixed to head B, and having shoulders *g*, adapted to lock against the head-shoulders 1 1 to allow the jaw

20 A² to swing inward for contracting the tool, substantially as herein set forth.

2. In a reaming-tool, the pivoted jaw connected with the tool-head by a joint providing shoulders, as at *a⁶* *a⁷*, on the jaw and head, respectively, substantially as specified, whereby should the jaw-pivot break the jaw will be retained by the tool-head, as set forth.

3. In a reaming-tool comprising a head, *a'*, a jaw, A', fixed thereto, a jaw, A², pivoted thereto, and an expander consisting of a tapering head, B, and a spring, C, connected therewith, the combination, with the tool-head *a'*, the expander-head B, and the spring C, of the screw-bolt D, connecting the spring adjustably

35 to the head *a'*, substantially as herein set forth.

4. In a reaming-tool, the combination, with the cutter-jaws A' A², adapted for expansion, substantially as specified, and the expanding-head B, of catches G G, fixed to head B and formed with inclined edges or faces *g'*, substantially as and for the purpose herein set forth.

5. In a reaming-tool, the combination, with the cutter-jaws A A', and the expanding-head B, provided with catches G G, and arranged substantially as specified, of pins G' G', fixed in one of the jaws and acting to draw the catches inward, and also to prevent loss of the expander should its connections break, substantially as herein set forth.

6. In a reaming-tool, the combination, with the cutter-jaws A' A², and the expanding-head B, arranged substantially as specified, of lips *b* on the head, and slots *b* in the jaws, to which the lips are adapted, substantially as herein set forth.

7. In a reaming-tool, the combination, with the jaws A' A², and the expander comprising a spring-drawn tapering head, B, placed between the jaws, of catches G, held to head B and provided with shoulders *g*, and the head *a'* of the tool being provided with opposite shoulders, 1 1 and 2 2, substantially as herein set forth.

WILLIAM ALEXANDER LLOYD.

Witnesses:

SAMUEL BESS,

FRANK BESS.

**Defendant's Exhibit Hobart & Ahearn U. S. Patent
No. 439,275.**

[Endorsed]: U. S. Dist. Ct., So. Dist. of Cal., So. Div. In Equity—No. 1540. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit Hobart & Ahearn U. S. Patent No. 439,275." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Hobart & Ahearn U. S. Patent No. 439,275. Filed May 8, 1917. F. D. Monckton, Clerk.

200 Wilson & Willard Manufacturing Company

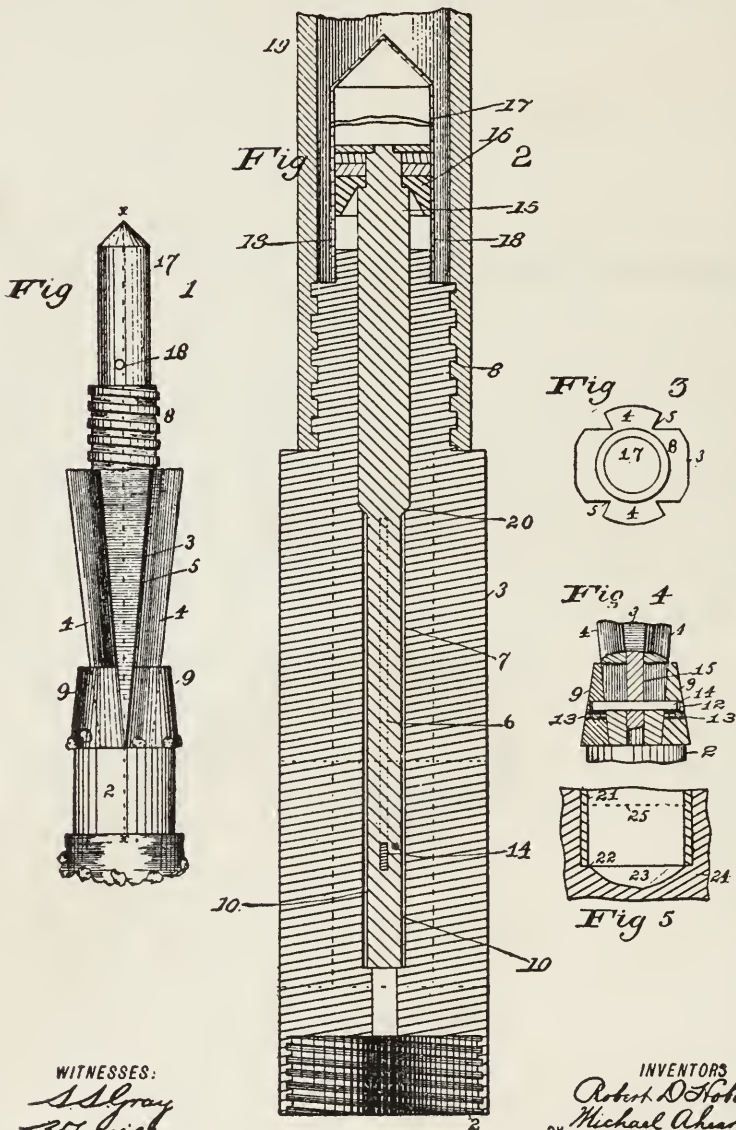
(No Model.)

R. D. HOBART & M. AHEARN.

ROCK DRILL.

No. 439,275.

Patented Oct. 28, 1890.



WITNESSES:

S. Gray
J. F. Wilson

INVENTORS

Robert D. Hobart
Michael Ahearn

BY *Wm. W. Dornick*
their
ATTORNEY

UNITED STATES PATENT OFFICE.

ROBERT D. HOBART, OF DENVER, AND MICHAEL AHEARN, OF
LEADVILLE, COLORADO.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 439,275, dated October 28, 1890.

Application filed November 12, 1888. Serial No. 290,556. (No model.)

To all whom it may concern:

Be it known that we, ROBERT D. HOBART, of Denver, in the county of Arapahoe, and MICHAEL AHEARN, of Leadville, in the county of Lake, and State of Colorado, citizens of the United States, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification, reference being had therein to the accompanying drawings, enabling any one skilled in the art to which the invention pertains to practice the same.

Our invention relates to an improved construction of rock-drills of that class or type wherein the drilling is effected by the use of rotating cutting or drilling edges; and its objects are to furnish a drill having a pair of expansible cutting-jaws, so that the diameter or bore of the hole drilled or being drilled may be enlarged at any desired point to such extent as is permitted by the amount of expansibility given such jaws, and so constructed, also, that these jaws may be instantly thrown into or out of operative position at will, such expansible and controllable jaws being combined, when desired or deemed necessary, with any of the ordinary types of non-expansible drill heads or points, the whole being of simple yet strong construction, efficient and reliable in operation, readily controlled and operated, and durable in use; to which ends the invention consists in the features, arrangements, constructions, and combinations more particularly hereinafter described and claimed.

In the drawings is illustrated an embodiment of our invention, wherein—

Figure 1 is a front view or elevation of our improved drill detached from the supporting tube or pipe; Fig. 2 an enlarged vertical section of the drill on line *x x*, Fig. 1, in position at the end of such tube or pipe; Fig. 3, a top view of the spindle or shank thereof; Fig. 4, vertical section of a part of the drill, taken in a plane at a right angle to the plane of Fig. 2; Fig. 5, a vertical section of the bottom of a well and its tubular casing.

In the figures is represented a complete drill or operating any suitable drilling or cutting ring or disk or drill-points, the reference-num-

eral 2 indicating a socket for the reception and retention of such ring or disk, such socket being formed with or secured to the end of a shank 3, tapered upon two opposite sides, the tapers or inclines of such opposite sides being regularly inward from the top or some other point a little distance above the socket down to the socket. Upon these inclined or tapered sides are the ribs 4 4, extending down to or about down to the socket 2. Each is undercut as to both its side walls, as shown at 5, so that the tops of such ribs are wider than their bases, and longitudinally through the center of these slots and the body of the shank is formed a slot 6, for a purpose hereinafter noted.

At the top of the shank, and somewhat smaller than the body of the shank, is a screw 8 or other suitable fastening device, by which the whole drill-head is affixed to the tube 19, to extend to the exterior of the drilled hole for the conveyance of power and water to the head.

9 9 are the expansible jaws, two being used as giving from their location opposite each other on the inclined ribs 4 4 equal resistance in work on both sides of the shank, and hence greater steadiness thereto. Each should be curved on its exterior either as to all or part thereof, and should also incline inwardly on its exterior from its lower edge or point where its cutting devices are placed to give better clearance. Each has a longitudinal groove along its inner center or flat surface, such grooves being undercut, as shown, to correspond and fit upon the under-cuts of the ribs 4, whence it is evident that if the jaws 9 be slid from the top upon such ribs 4 they are locked thereto in rotary motion, but that horizontal or longitudinal movement of either the shank with its socket 2 or the expansible jaws 9 9 is permitted relatively to each other. These jaws are of such size that when lying, as they normally do, at the lower end of the shank and upon or as near to the socket as permitted, they will come within the area of the bore made by the drilling device carried by the socket and readily pass therethrough; but it is readily seen that if raised upon the inclined ribs 4 4 they will be thrown outwardly pro-

portionately to the incline of such ribs in the distance they are raised and ream or drill beyond the drilling limit of the ring or disk carried by the socket 2, and means for such raising will now be described. Through the center of the shank 3 is a longitudinal aperture 7, forming a guide and a seat for a piston-rod 15, carrying at its upper end a piston 16, provided with any customary or suitable packing, and situated within the cylinder 17, secured upon a reduced portion of the screw-top 8 by a male and female thread or by any other suitable means. The cylinder 17 extends upwardly within the tube 19 and is of a length somewhat greater than the amount of movement to be given to the expanding-jaws 9 9. Near its base one or more perforations 18 are made through its wall, whereby water may pass to its interior from the tube 19.

As before stated, a longitudinal slot 6 is made entirely through the ribs 4 4 and shank 3. In addition thereto a hole for the reception of a pin is made through the lower end or in the lower part of the piston-rod 15. In each jaw 9 a hole for the reception of a pin or screw 13 is made through its wall into its interior groove, and just above such hole a chamber or recess 12 is formed. The jaws 9 9 being placed upon the ribs 4 4 and the piston-rod 15 put in position, the parts are put in such relation that the holes for the pins or screws 13 13 and the one in the piston-rod and the slot 6 coincide or are in line, when a pin 14, of length about equal to the distance from the outer end of one chamber 12 to the outer end of the other, when the jaws 9 9 are in their normal or lower position, is passed through the holes and the slot, securing the jaws to the piston-rod. The piston-rod being then slightly raised, the pin 14 passes into the chambers 12, whereupon blind screws or pins 13 are placed in the holes therefor, extending inwardly nearly or quite to the piston-rod. The outer walls of the chambers 12 12 prevent the pin 14 from becoming detached from the jaws and piston-rod, while the blind screws or pins, as either is used, retain the pin within such chambers.

It should be noted that the parts should be adjusted so that when in normal position the piston 16 may not fall within the cylinder 17 below or even quite to the apertures 18, in order that water entering the cylinder shall always enter below the piston. The piston-rod should be so fitted to the aperture in which it works in the shank 3 that there may be an escape of water around the same, and that such escape shall be slower than the inlet through the perforations 18, that a pressure of water may be had within the cylinder 17 when necessary. To this end the contracted part of the piston-rod 15—that is, the part below the shoulder 20—is slightly smaller than the passage through the shank it takes in, a small passage 10 being thereby left around that part of the piston-rod. When the piston is raised to a sufficient height

within the cylinder 17 to throw the jaws 9 well out, the larger part of the piston-rod passes out of the aperture through the shank and the water escapes below the shoulder 20 and around the smaller part of the piston-rod.

Supposing it be desired to enlarge the bore of a drill-hole at any point of its length or its depth, the drill-head attached to the tube 19 is inserted therein to the proper point. Water under proper pressure is then admitted to the tube 19, and such proper pressure may be obtained by mere height of column, or, where such height of column is not attainable or the position of the tube will not give the pressure, by forcing or pumping water into the tube 19. Such water, with whatever pressure is given it, enters the cylinder 17 between the piston 16 and top of screw-head 8, forcing the former upwardly in the cylinder. As it rises it carries, through the medium of the piston-rod, the jaws 9 9 up the inclined ribs 4 4, so that their cutting devices are thrown outwardly beyond the plane of any cutting devices carried by a ring or disk in the socket 2 and operate on material beyond the drilling limit of the latter. Where a mere enlargement at some point is desired, a ring or disk in socket 2 need not be used; but where a well or drill-hole is to be deepened or a casing extended in a drilled well beyond a point at which the casing then extends, a drill ring, disk, or points should be used in the socket, that the bore may be kept uniform, a drill-head of size sufficient to pass through the well or its casing being used and the enlargement beyond that made by the use of the expansible jaws. So long as this requisite pressure of water is maintained the jaws will be kept in the elevated and outwardly-thrown or operative position; but so soon as such pressure is removed they will by their own gravity fall to their normal or inoperative position, so that they are readily controllable by the application of water-pressure to or the withdrawal thereof from the piston within the cylinder.

It is evident that the expanding-jaws and inclined ribs, instead of being kept in sliding engagement by regular inclined under-cuts or bevels, as shown, could be kept in such engagement by a groove on one part and a rib upon the other, similar or akin to a feather and spline. No matter, however, what means of keeping these parts in sliding engagement are used, it is readily seen that if the cutting or drilling edges of the expansible jaws take upon a ledge or shoulder of sufficient hardness within a well or drill-hole the resistance of such shoulder and the gravity of the head will cause the jaws to be thrown upward and expanded to enlarge the bore of the hole automatically and without the use of the piston and the water to act thereon. For instance, referring to Fig. 5, suppose 21 to be the casing of a drilled hole or well resting upon the shoulder or bottom 22 of the drill-hole. Usually a pocket 23 is formed either by the action

of water or other causes in the matter 24; but, whether such a pocket be formed or not, suppose it be desired to deepen such well or other drill-hole and so deepen it that the casing and bore may be of uniform size. In such case the casing is lifted to a short distance—for instance, to the dotted line 25—and the drill with the expansible jaws lowered. When the drill-head reaches the point below the line 25, the expansible jaws may be thrown out automatically by contact with the shoulder 22 and take thereupon, enlarging the bore, so that when desired the casing may be forced to the bottom of the addition of the well or drill-hole, or they may be thrown out by the action of the piston operated on by water admitted to its cylinder.

Having thus described our invention, what we claim is—

20 The combination, in a drill-head, of a shank

tapered on opposite sides and having ribs upon such tapered or inclined sides, expansible jaws located and adapted to slide upon such ribs, a piston-rod moving in an aperture in the shank of the drill-head and secured to the 25 jaws, a piston at the outer end of such rod, and a cylinder upon the end of the drill-head, within which such piston plays, and having inlets for water between the end of the drill-head and the piston, substantially as set forth. 30

In testimony whereof we affix our signatures in presence of two witnesses to each.

ROBERT D. HOBART.

MICHAEL AHEARN.

Witnesses to signature of Hobart:

Z. F. WILBER,

WILLIAM R. BARBOUR.

Witnesses to signature of Ahearn:

A. LYNCH,

JOHN K. RYAN.

Defendant's Exhibit U. S. Deisch Patent No. 526,440.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. No. 1540—In Equity. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit U. S. Deisch Patent No. 526,440." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Deisch Patent No. 526,440. Filed May 8, 1917. F. D. Monckton, Clerk.

(No Model.)

J. DEISCH.
WELL BEAMER.

No. 526,440.

Patented Sept. 25, 1894.

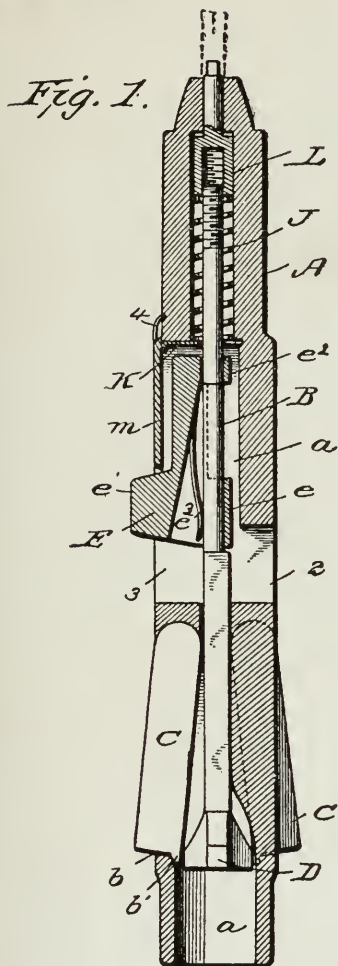
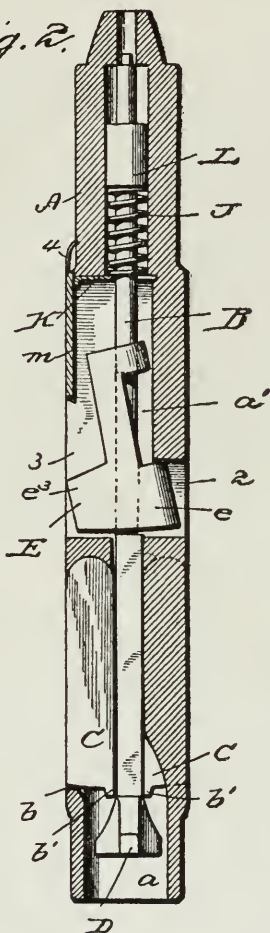


Fig. 2.



Witnesses
Wm. L. (Signature)
E. R. (Signature)

Inventor
John Deisch
Per Resalt (Signature)
Attorney.

UNITED STATES PATENT OFFICE.

JOHN DEISCH, OF WHITE LAKE, SOUTH DAKOTA.

WELL-REAMER.

SPECIFICATION forming part of Letters Patent No. 526,440, dated September 25, 1894.

Application filed May 31, 1894. Serial No. 513,093. (No model.)

To all whom it may concern:

Be it known that I, JOHN DEISCH, a citizen of the United States, residing at White Lake, in the county of Aurora and State of South Dakota, have invented certain new and useful Improvements in Well-Reamers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention aims to provide a reamer for enlarging the bore of Artesian and oil wells below the well tubing which will be automatic in its action expanding as soon as the bits clear the well tubing through which the tool is passed and again contracting on withdrawing the tool through the said tubing, the bits being locked in their expanded position to prevent their yielding when striking rock or gravel thereby insuring the removal of the latter and the enlargement of the bore to the limit of the cutting edges of the bits.

The improvement will be more fully set forth hereinafter and claimed and is shown in the accompanying drawings, in which—

Figure 1, is a vertical section of the tool showing the relative disposition of the parts when the bits are expanded and locked, and Fig. 2 is a view similar to Fig. 1 showing the position of the parts when the bits are withdrawn within the outer walls of the stock.

The letter A represents a stock constructed at its upper end to receive the operating rod and longitudinally bored to receive and permit of the free working of the rod B carrying the spreader head D. The lower portion *a* of the bore is enlarged sufficiently to receive the spreader head and admit of the same having a limited reciprocating movement therein. Longitudinal slots *b* extend through the sides of the stock and receive the bits C which come flush at their outer surfaces with the sides of the stock. The upper ends of the slots *b* are concaved to receive the rounded ends of the bits which articulate therein as the lower ends swing in and out. Shoulders or projections *b'* at the inner lower corners of the bits limit their outward movement by engagement with

the inner walls of the bar contiguous to the lower ends of the slots *b*. The upper portion *a'* of the bore is reduced or smaller than the bore *a* and has two diametrically disposed slots 2 and 3, the slot 3 being the larger to receive the locking head E and admit of its having a limited movement therein.

A projection or shoulder *e* of the part E is constructed to enter the slot 2 when the head E is at the lower limit of its movement and hold the spreader at its lowest position when the said locking head is pressed in laterally by the well tubing when passing the tool through the same either for removing or adjusting to place. The locking head is mounted on the rod B and the opening therein increases in width from the upper to the lower end to admit of the latter swinging laterally. One side is cut away forming the projection *e'* and the loop *e²*, the latter engaging with the shoulder on the rod B to cause the rod and the head to move up together. A spring *e³* exerts a lateral pressure on the rod B to hold the lower end of the locking head at the limit of its outward movement, so that the lateral extension *e'* will normally project beyond the side of the stock. The upper end of the extension *e* is beveled to glance the side on the lower end of the well tubing when the tool is withdrawn within the same. A coil spring J is fitted in the upper part of the bore *a'* above the slot and is mounted on the upper end of the rod B being confined between a plate K provided at the upper end of the slot 3 and sliding in ways or grooves on the sides thereof, and an adjustable stop on the threaded end of the rod B. The spring is normally compressed and has a tendency to move the rod B upward and its tension is regulated by adjusting the stop L which is effected by means of a key or wrench shown by the dotted lines in Fig. 1, which is fitted to the end of the stop and inserted through the further reduced bore of the stock. The upper portion of the slot 3 is closed by a slice *m* held in ways in the sides of the said stock and retained in place by a spring catch. There will be as many bits C as required and they will be distributed at proper intervals about the sides of the stock.

Normally the locking head and the rod with the spreader head, occupy the higher

limit of the movement and the bits are expanded, being locked by the spreader head which is forced between their lower ends. To pass the tool through a well tubing of proper size to correspond with the diameter of the stock, the head E is moved to the limit of its lowest position in the slot 3. This operation moves the spreader head from between the inner ends of the bits and permits the latter to contract. After the tool passes below the lower end of the tubing so as to release the head E the latter moves laterally, and the spring J moves the rod B upward forcing the spreader head D between the lower ends of the bits and pressing the latter outward. On withdrawing the tool the projection *e* of the locking head striking the lower end of the tubing moves the head down to the lower end of the slot 3, and laterally so that the projection *e* enters the slot 2. This operation moves the rod down and withdraws the spreader head from between the lower ends of the bits and permits the latter to contract or pass within the sides of the stock which is easily removed through the tubing.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A tool for the purposes set forth comprising a stock, bits adapted to be projected beyond the sides of the stock, a spreader head for locking the bits in their expanded position, a rod attached to and carrying the

spreader head, a spring for normally retaining the spreader head between the ends of the bits, and a head mounted upon the said rod to move therewith and having a lateral extension normally projecting beyond the side of the stock, and having the opening through which the rod passes increasing in width from the top to the bottom end, to permit of the lateral movement of the said head, substantially as specified. 35 40

2. In combination a stock longitudinally bored, having slots *b* and 2 and 3 in its sides, bits fitted in the slots *b* and articulating with the upper ends thereof, the lower ends having stops to limit their outer movement, a spreader, a rod attached to the spreader, a spring mounted on the rod and arranged to normally hold the same at the limit of its upward movement, a head mounted on the rod and adapted to work in the slot 3, one side being cut away to form a loop *e* and a projection *e*³, the latter constructed to enter the slot 2, the opening in the head widening from the top to the bottom, and a spring in the head to bear laterally on the rod to project a lateral extension of the said head beyond the side of the stock, substantially as specified. 50 55 60

In witness whereof I affix my signature in presence of two witnesses.

JOHN DEISCH.

Witnesses:

M. E. LONG,

A. DOTY.

Defendant's Exhibit U. S. Yorke Patent No. 475,913.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. No. 1540—In Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. “Defendant's Exhibit U. S. Yorke Patent No. 475,913.” Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Yorke Patent No. 475,913. Filed May 8, 1917. F. D. Monckton, Clerk.

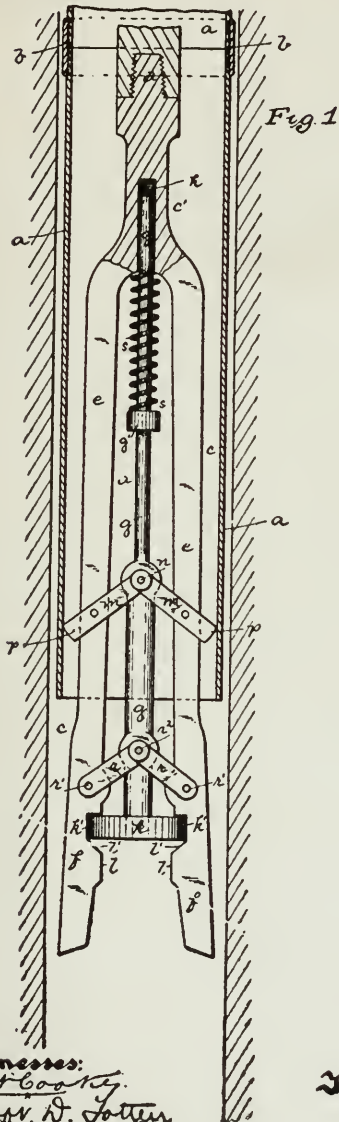
(No Model.)

P. YORKE.

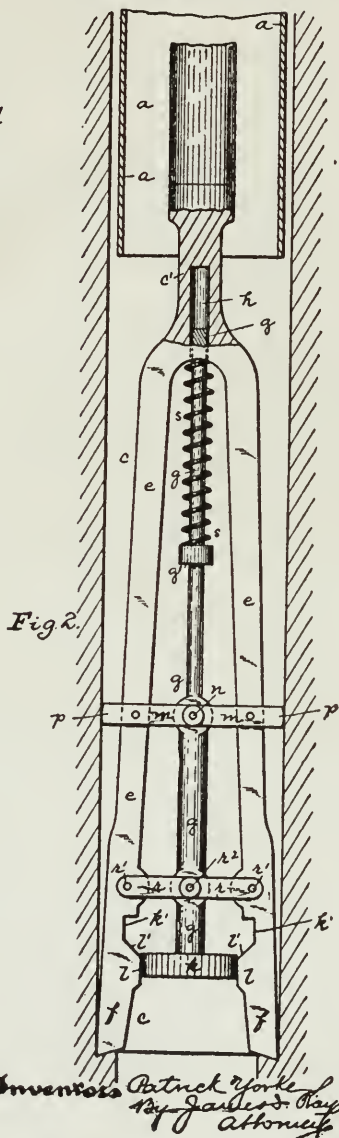
APPARATUS FOR DRILLING ARTESIAN WELLS.

No. 475,913

Patented May 31, 1892.



Business:
J. H. Cooley.
Rev. W. L. Lottin



Inventor Patrick York
By James H. York
Attorney

UNITED STATES PATENT OFFICE.

PATRICK YORKE, OF WASHINGTON, PENNSYLVANIA.

APPARATUS FOR DRILLING ARTESIAN WELLS.

SPECIFICATION forming part of Letters Patent No. 475,913, dated May 31, 1892.

Application filed May 4, 1891. Serial No. 391,493. (No model.)

To all whom it may concern:

Be it known that I, PATRICK YORKE, a resident of Washington, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Drilling Artesian Wells; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to tools for drilling oil and other Artesian wells, its object being to provide what might be termed an "under reamer or tool" for drilling through tubing, which may be inserted in the well for the full diameter for which the well had heretofore been drilled by means of an expanding reamer, which can be inserted through the well-tubing and expanded below the same and then contracted so as to be withdrawn.

The present invention consists, generally stated, in certain improvements in such class of reaming-tools, as will be hereinafter fully described and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a view illustrating the manner of introducing the reamer into the well and passing it down through the tubing thereof and withdrawing the tool, and Fig. 2 is a like view illustrating the manner in which the tool is employed for under reaming.

Like letters of reference indicate like parts in both figures.

The well-tubing *a* is usually made in sections about eighteen feet in length, and is connected by threaded coupling sockets or collars *b*, screwed around the outer faces thereof, so requiring the bore of the well to be of a diameter sufficient to receive the tubing and the coupling-sockets, as shown. The ordinary well varies in different parts from thirteen inches in diameter to five and one-half inches, according to the different points at which a drilling operation is carried on and according to the number of lines of tubing within the well; but for the ordinary drilling it may be presumed that the well is of the full bore of thirteen inches. The under reamer

c has formed at its upper end a threaded pin *d*, by which it is connected to the ordinary string of tools within the well, such as to the drill-jars, and above that to the rope. The reamer is formed with the two arms *e e* extending down from the upper or body portion *c'* thereof and having formed at their lower ends reaming-bits *f f*, arms *e e* being spring-arms and being naturally adapted to spring out as soon as they are released by the mechanism hereinafter described. When so released, as shown in Fig. 2, the reaming-bits *f f* are adapted to extend out a sufficient distance to ream out the well to a diameter sufficient to receive the tubing—that is, in the illustration above referred to to a diameter of thirteen inches. When the tool is closed up, however, as shown in Fig. 1, the entire tool may be passed down through the tubing *a*, so that it may be inserted within the well and withdrawn therefrom when necessary. This is accomplished in the following manner. Sliding between the two arms *e e* of the reaming-tool is the central bar *g*, the upper end of which fits within the socket *h*, while its lower end carries what I have termed the "wedge" *k*, which wedge, when the tool is closed to pass through the tubing, fits into seats *k* in the arms *e e*, but which wedge, when it is lowered in the manner hereinafter described, is adapted to enter the space between the shoulders *l l* on the inner faces of the arms *e e* and hold the reamer open, expanding the arms a sufficient distance to enable it to ream out the well to the full diameter required, the wedge *k* being guided in its course from the seats *k* to between the shoulders *l* by the inclines *i*. If desired, the seats *k* may be dispensed with and the wedge *k* be made of smaller diameter while the shoulders extend in farther than illustrated, for some tools this being desirable in order to prevent the weakening of the arms *e*. The central bar *g* is connected to the arms *e e* by two sets of levers, the upper levers *j* being hinged or pivoted to the bar at *n*, on their free ends *p* extending beyond the arms *e* in such position that as soon as the levers *m m* pass below the base of the line of tubing they may extend beyond it, as shown in Fig.

475,913

so as to permit the opening to the tool and the passage of the wedge *k* between the shoulders *l*, but said free ends *p* of said levers bearing upon the inner face of the line of tubing when the tool is lowered through the well, and so providing means for closing the tool when it is desired to withdraw the same from the well, the free ends of the levers striking against the base of the tubing and being forced inwardly and downwardly thereby, and so drawing upwardly the wedge *k* and drawing together the two arms of the reamer. Below said levers *m* and just above the wedge *k* I also employ the links *r*, connected to the arms at *r'* and to the bar *g* at *r*², said levers acting to limit the spread of the reaming-tool and acting with the wedge *k* to hold the same rigid during the reaming operation. In order to force down the central bar *g*, and so cause the opening of the tool as soon as the levers pass the base of the tubing, I employ a heavy spring *s*, confined around the bar *g* and between the top or body *c'* of the tool and the rear *g'* on the bar, which spring will act to force the bar *g* downwardly as soon as the free ends *p* of the levers *m* will permit the spreading of the tool, and will so act to force the wedge *k* between the shoulders *l*, said spring also acting to resist the heavy strain or jar which might come upon the tool in the reaming operation, and might act to cause the closing thereof by jarring the wedge *k* from between the shoulders *l*.

The invention may be practiced and the improved reaming-tool may be employed in different ways, according to the work to be done. For example, let it be supposed that a line of tubing has been carried down into a well the desired distance—such, for example, to cut off a vein of salt water—and that the driller encounters a strata of treacherous or caving rock and that he has difficulty in drilling through the same. In such cases, instead of working through the strata of caving rock and then putting in a second line of tubing, he would simply raise the tubing a sufficient distance to permit the reaming-tool to work under the same and hold the tubing in that position. He would then close together the reaming-tool and insert it within the tubing and permit it to pass down within the well. As it is passing down through the tubing the free ends *p* will bear against the inner face of the tubing and hold the reamer in its closed position; but as soon as the levers *m* pass below the base of the tubing the spring *s* will force down the central bar *g* through the levers *m* and links *r*, extending the tool and at the same time forcing the wedge *k* between the shoulders *l* of the arms *e*, and so locking the tool in its extended position. By raising and lowering the tool in the ordinary operation the driller is then enabled to ream out the well to the full diameter sufficient to receive

the line of tubing, and he can continue to ream out the well until he gets below the difficulty encountered, such as until he gets below the caving rock, and at the same time he can protect his reaming-tool, or, for that matter, the drilling-bit, which can operate through the tubing by suspending the line of tubing sufficiently close to the tool to prevent any rock from falling in and clogging or wedging around the tool, and so locking it within the well. When it is desired to withdraw the reaming-tool from the well, it is only necessary to draw up thereon with sufficient pressure to overcome the force of the spring *s*, when as the free ends *p* of the levers *m* strike the lower end of the line of tubing they will be forced downwardly and inwardly and will force the central bar *g* upwardly, so as to compress the spring and withdraw the wedge *k* from between the shoulders *l*, so providing for the drawing of the tool within the tubing, and the free ends *p* of the levers *m* will hold the arms *e* of the reamer in their closed position, so that the reamer may be drawn through the tubing. If desired, the operator in starting his well may employ a smaller diameter of tubing and may tube or case his well continuously for any distance he may find desirable, simply drilling through the tubing, and then by means of the under reamer ream out the well to a sufficient diameter to receive the tubing and then lowering the line of tubing, adding section by section thereof at the upper end.

By my invention I provide for the drilling of all wells without the necessity of inserting a separate length of tubing extending from below any particular obstruction to the top of the well, as I am enabled to employ but one diameter and one line of tubing within the well. I am also enabled to drill the well by lowering the tubing, at the same time to hold back any caving rock which might act to clog or lock the tools within the well, so overcoming the danger of the loss of the tools or the loss of the well, and providing easy means of passing through any strata of caving rock encountered. I also reduce to a great extent the cost of drilling such wells by the saving in the cost of the tubing employed.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A reamer for Artesian wells, having two arms carrying bits at the lower ends thereof, a central bar longitudinally movable with relation thereto, and lever connections extending between and connected to said arms, said bar to provide for the closing and expanding of such arms, said levers having free ends adapted to extend beyond the arms of the reamer, substantially as and for the purposes set forth.

2. A reamer for Artesian wells, having two arms carrying bits, a central bar longitudinally movable with relation thereto and car-

475,913

rying a wedge at the base thereof, and the levers pivoted to said bar and arms and having the free ends extended beyond the arms, substantially as and for the purposes set forth.

5 3. A reamer for Artesian wells, having two arms carrying bits, a central bar *g*, longitudinally movable with relation thereto and carrying the wedge *k* at the base thereof, the levers *m m*, pivoted to said bar and arms and
10 having the free ends *p* and the links *r*, piv-

oted to said bar and arms near said wedge block, substantially as and for the purposes set forth.

In testimony whereof I, the said PATRICK YORKE, have hereunto set my hand.

PATRICK YORKE,

Witnesses:

J. N. COOKE,

ROBT. D. TOTTEN.

Defendant's Exhibit U. S. Allen Patent No. 294,302.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. No. 1540—In Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit U. S. Allen Patent No. 294,302." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams. Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Allen Patent No. 294,302. Filed May 8, 1917. F. D. Monckton, Clerk.

(No Model)

O. ALLEN.

EXPANSIBLE DRILL.

No. 294,302.

Patented Feb. 26, 1884.

Fig 1



Fig. 2.

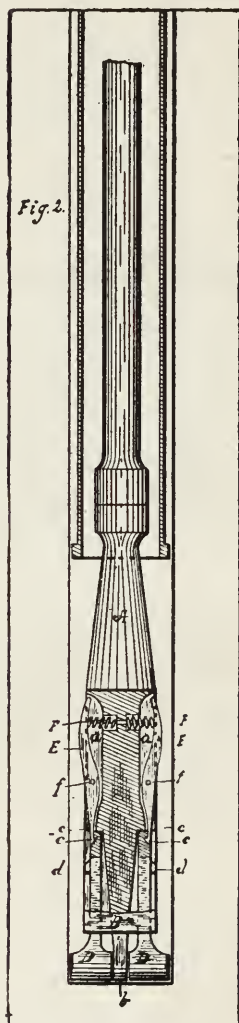
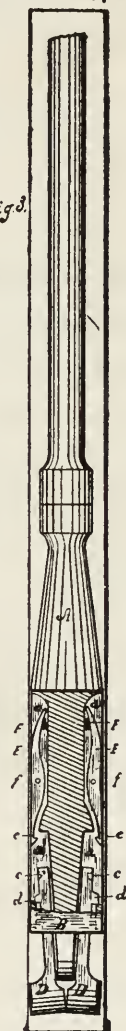


Fig. 3.



Witnesses

James Cohen
O. Allen

Inventor

Oren Allen
By a McNulty
Attorney

UNITED STATES PATENT OFFICE.

ORREN ALLEN, OF DENVER, COLORADO.

EXPANSIBLE DRILL.

SPECIFICATION forming part of Letters Patent No. 294,302, dated February 26, 1884.

Application filed January 28, 1884. (No model.)

Call whom it may concern:

Be it known that I, ORREN ALLEN, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Expansible Drills, of which the following is a specification, reference being had herein to the accompanying drawings.

My invention relates to improvements in 10 expansible drills, in which the cutting part is made separable and adjustable; and the objects of my improvements are to provide a drilling-tool that can be compressed sufficiently to be lowered into wells through the casing, 15 and expanded sufficiently below the terminus of the casing to drill the well the same size of that containing the casing, which enables operators to bore wells a uniform size through any material that is capable of being penetrated by drills to any desired depth. These 20 objects I attain by means of the device illustrated by the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of the drill; 25 Fig. 2, a side and part sectional view, showing the tool expanded, as in use; Fig. 3, a side and part sectional view compressed, showing the tool in the position assumed while being raised or lowered through the casing.

Similar letters and figures refer to similar parts throughout the several views.

A in the drawings represents the main stem of the drill, having grooves *a a* therein, and having the guard B attached thereto. The 30 lower extremity of the stem A is pointed, as shown in the drawings at *b*.

In the grooves *a a*, and within the guard B, are placed supplemental drills D D, having the 35 projections *d d* thereon, which prevent the supplemental drills dropping below the position shown in Fig. 3, being the position assumed during the process of raising and lowering the tool through the casing. The upper ends of the supplemental drills have notches C 40 made therein, which receive the catches E, which serve the purpose of retaining the drills D D in the position shown in Fig. 2 while in operation. The catches E are pivoted in the grooves *a a* by means of the bolts *f*.

To the upper ends of the catches E are at-

tached springs F, as shown in Fig. 2, which hold outward the upper ends of the parts E in such a manner as to retain the catches in contact with the notches C C of the drills D D.

In the use of my invention, the drill, arranged 55 as shown in Fig. 3, is in position to be lowered into the well through the casing, which may extend down within a few feet of the bottom of the bore. When the supplemental drills reach the bottom of the hole, they spread apart 60 at their lower ends, which allows the part *b* of the main stem A to enter between the drills D D, forming a drilling-surface the same width of that part of the well containing the casing. (See Fig. 2.) The catches E engage with the 65 notches C, which retains the supplemental drills D D permanently in that position while the operation of drilling is being carried on. When it becomes necessary to raise the drill out of the well, the drill is raised upward by 70 any suitable means. When the upper ends of the parts E come in contact with the inner circumference of the casing, they are compressed inward, as shown in Fig. 3, which carries outward the catches, releasing the sup- 75 plemental drills D D, which allows them to drop downward into the position shown in Fig. 3, and which admits of their closing together in such a manner as to be drawn upward through the casing with ease. By this 80 means the impossibility heretofore experienced in continuing wells a uniform size through alternate strata of rock and quicksand or mud is entirely overcome.

Having thus fully described the construction 85 and use of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The hereinbefore-described expansible drill, consisting, substantially, of the stem A, having grooves *a a* made therein, and the guard 90 B, affixed thereto, as set forth, the supplemental drills D D, having-extensions *d d* thereon, and provided with notches C, the catches E, and spring F, all operating as described and specified, and for the purpose set forth. 95

2. The stem A, having grooves *a a* therein and guard B, attached thereto, as specified.

3. The supplemental drills D D, pointed at their lower extremities, and provided with notches C. 100

4. The catches E, fulcrumed between the sides of the stem A, by which the supplemental drills are sustained in position.

5 In an expansible drill, the combination, with the stem A, having grooves *a a* therein, and the guard B, attached thereto, as set forth, of the supplemental drills D D, as specified and described.

10 6. In an expansible drill, the combination, with the stem A, having grooves *a a* therein, and the guard B, attached thereto, and the supplemental drills D D, of the catches E E and springs F, all operating as described and specified.

7. In an expansible drill, a stem forming a drill, supplemental drills by which the cutting-surface is increased, suitable means of retaining the drills in position to penetrate rock or other materials, and suitable means of retaining the drill in position to be raised and lowered through the casing, as described and specified.

In testimony whereof I affix my signature in presence of two witnesses.

ORREN ALLEN.

Witnesses:

FRANK Q. STUART,
GEO. W. ALLEN.

**Defendant's Exhibit U. S. Carruthers Patent No.
479,933.**

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal.,
So. Div. No. 1540—In Equity. Union Tool Com-
pany et al. vs. Wilson & Willard Mfg. Co. “De-
fendant's Exhibit U. S. Carruthers Patent No.
479,933.” Leo Longley, Special Examiner. Filed
Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas.
N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the
Ninth Circuit. Defendant's Exhibit U. S. Car-
ruthers Patent No. 479,933. Filed May 8, 1917. F.
D. Monckton, Clerk.

(No Model.)

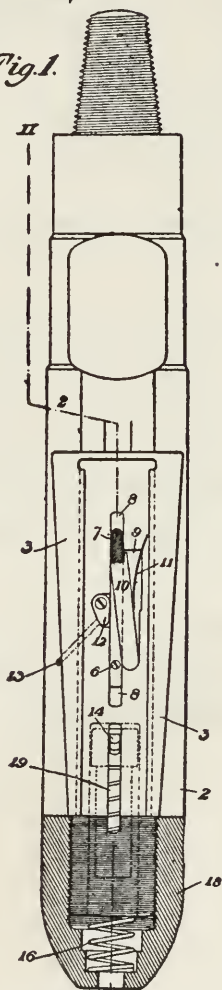
J. CARRUTHERS.
CASING SPEAR.

2 Sheets—Sheet 1.

No. 479,933.

Patented Aug. 2, 1892.

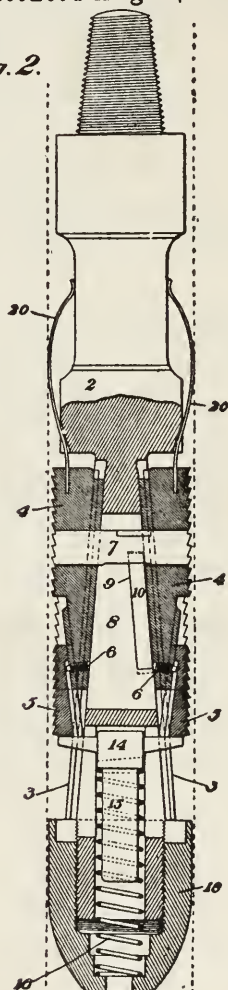
Fig. 1.



WITNESSES

A. L. Gill
L. Byrnes.

Fig. 2.



INVENTOR

John Carruthers
by H. Bakewell & Son
his attorneys

(No Model.)

J. CARRUTHERS.
CASING SPEAR.

2 Sheets—Sheet 2

No. 479,933

Patented Aug. 2, 1892.

Fig. 3.

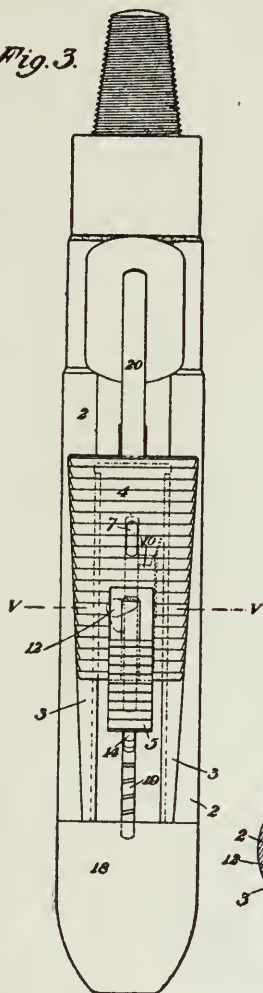


Fig. 4.

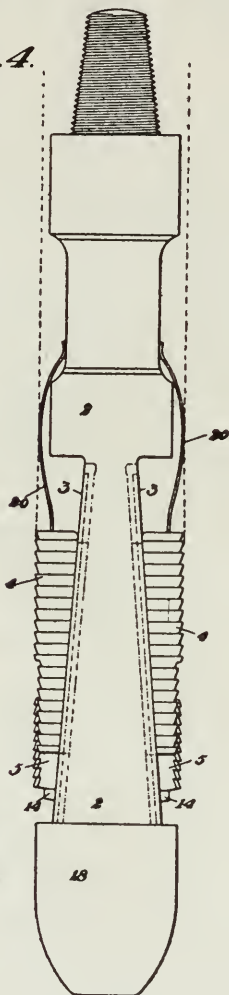
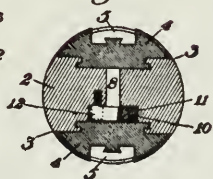


Fig. 5.



WITNESSES

H. L. Gill.
C. Byrnes.

INVENTOR

John Carruthers
by T. B. Baskin
his attorney

UNITED STATES PATENT OFFICE.

JOHN CARRUTHERS, OF HARMONY, PENNSYLVANIA, ASSIGNOR OF
ONE-HALF TO MYRON J. PETERS, OF SAME PLACE.

CASING-SPEAR.

SPECIFICATION forming part of Letters Patent No. 479,933, dated August 2, 1892.

Application filed April 18, 1892. Serial No. 429,562. (No model.)

To all whom it may concern:

Be it known that I, JOHN CARRUTHERS, of Harmony, in the county of Butler and State of Pennsylvania, have invented a new and

5 useful Improvement in Casing-Spears, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

10 Figure 1 is a side elevation, partly in section, of my improved casing-spear, showing the same locked for withdrawal from the casing. Fig. 2 is a vertical sectional view on the line II II of Fig. 1. Fig. 3 is a side elevation

15 of the spear, showing in dotted lines the pawl withdrawn and the parts ready for lowering in the well. Fig. 4 is a side elevation at right angles to Fig. 3, showing the parts in position for jarring upwardly on the casing. Fig. 5 is

20 a cross-section on the line V V of Fig. 3.

My invention relates to the casing-spears employed for the purpose of removing a casing from a well or for loosening it and permitting it to be shifted; and it consists in the peculiar construction and arrangement of the

25 parts, as hereinafter more fully described, and set forth in the claims.

In the drawings, in which like numerals indicate corresponding parts, 2 represents the

30 body of the casing-spear, upon the inclined slideways 33 of which are mounted the ribbed or barbed wedge-slips 44, moving in dovetailed grooves in said slideways. The barbs upon the slips 44 are upwardly directed, so

35 that they are adapted to bite on the casing when the spear is moved upwardly therein.

55 are barbed wedge-slips dovetailed in inclined slideways on the wedges 44 and limited in their downward movement by studs or

40 screws 6, which fit in inner grooves of said wedges. The barbs on the second set of slips are downwardly directed, so that they shall be adapted to engage the casing when the

45 spear is moved down. The first set of slips 4 are connected by the cross-bar 7, which moves in the slot 8, extending between the slips, and pivoted in a recess 9 of the body is

50 a pawl or latch 10, which is pressed outwardly by the spring 11. A trigger 12, mounted in the body on the opposite side of the slot, is arranged to engage said pawl and push the

same back against the action of the spring by means of a rod passed through the hole 13, extending to the outside of the body. Bearing upon the lower ends of the slips 55 is a cross-head 14, supported upon a vertically-movable post 15, carried upon and supported by a spiral spring 16, which incloses the same and bears upon an annular shoulder on its upper portion. This spring at its lower end bears upon the bottom of the central recess of a cap 18, which is screwed upon the lower tubular end of the spear-body. The ends of the cross-head project through a second slot 19 beneath and in line with the slot 8 and bear upon the wedges 5, as above stated. To prevent the rubbing and wearing away of the teeth on the slips, I provide two springs 20, which are arranged to bear against the inside of the casing, which is indicated in dotted lines, and hold the slips out of contact therewith.

To operate the device, a rod is inserted through the hole 13 and the trigger pushed into the position shown by dotted lines in Fig. 3, thus disengaging the pawl 10. The slips 55 hang at the lower portion of their reciprocating path, and in this position their peripheries lie in a smaller circle than that of the upper wedges 44. The device being lowered within the casing at the end of a string of tools, the slips 44 move up in their inclined seats and permit its easy descent. When the portion of the casing which it is desired to seize has been reached, the operator jars upwardly on the tools, and in such upward jarring the slips 44 bite on the casing, and further lifting or upward jarring of the spear will move the casing. When the casing has been properly loosened or sufficiently raised in the well and it is desired to withdraw the spear therefrom, the operator jars down on the tool-stock. The effect of this is to loosen the slips 44 by the downward movement of the stock, to push aside the trigger by the cross-bar, and to thrust out the slips 55, which support the weight of the tools and are prevented from moving downward by the barbs thereon. The spiral spring serves to maintain a yielding pressure upon these slips. The slips 44, now resting upon the upper part of the slideways, are retracted and the spear may be withdrawn without difficulty

479,933

the teeth or barbs upon the slips 55 slipping over the casing, so that if the spear should dip they would bite on the casing and uphold the same.

The advantages of the device are obvious. The device is much simpler than other spears formerly used and is positive and certain in all its motions, while the blocks of wood heretofore inserted to hold up the wedges until the spear reached the proper position and then broken down by jarring are dispensed with.

I claim as my invention—

1. In a casing-spear, the combination, with the tool-stock, of two contrarily-acting sets of wedge-slips, one set being mounted upon inclined guideways on the stock and the second set being mounted upon similar oppositely-inclined guideways upon the first set, and a pawl for locking the first set in retracted position, substantially as and for the purposes described.

2. In a casing-spear, the combination, with the tool-stock, of a set of wedge-slips mounted in inclined guideways thereon, a cross-bar connecting the slips and moving in a slot passing through the stock, a spring-pawl arranged to engage said cross-bar, and a second set of contrarily-acting wedge-slips mounted in reversely-inclined guideways upon the first set, substantially as and for the purposes described.

3. In a casing-spear, the combination, with the tool-stock, of a set of wedge-slips mounted in inclined guideways thereon, a cross-bar 35 connecting the slips and moving in a slot passing through the stock, a spring-pawl arranged to engage said cross-bar, a second set of contrarily-acting wedge-slips mounted in reversely-inclined guideways upon the first set, a 40 cross-head moving in a second slot passing through the stock, and a spiral spring surrounding the stem supporting said cross-head, substantially as and for the purposes described. 45

4. In a casing-spear, the combination, with the tool-stock, of a set of wedge-slips mounted in inclined guideways thereon, a cross-bar connecting the slips and moving in a slot passing through the stock, a spring-pawl arranged 50 to engage said cross-bar, a trigger arranged to engage the spring-pawl, a hole extending from said trigger to the exterior of the casing, and a second set of contrarily-acting wedge-slips mounted in reversely-inclined guideways 55 upon the first set, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 30th day of March, A. D. 1892.

JOHN CARRUTHERS.

Witnesses:

W. B. CORWIN,
H. M. CORWIN.

**Defendant's Exhibit U. S. Duncan Patent No.
662,895.**

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal.,
So. Div. No. 1540—In Equity. Union Tool Com-
pany et al. vs. Wilson & Willard Mfg. Co. "De-
fendant's Exhibit U. S. Duncan Patent No. 662,895."
Leo Longley, Special Examiner. Filed Apr. 16,
1913. Wm. M. Van Dyke, Clerk. By Chas. N.
Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the
Ninth Circuit. Defendant's Exhibit U. S. Duncan
Patent No. 662,895. Filed May 8, 1917. F. D.
Monckton, Clerk.

No. 662,895

W. DUNCAN.
UNDERREAMER.

Patented Nov. 27, 1900.

(Application filed Apr. 4, 1900.)

(No Model.)

Fig. 1

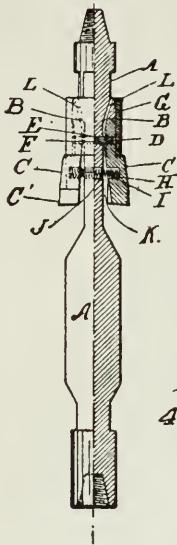


Fig. 2.

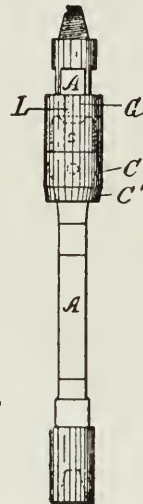


Fig. 3

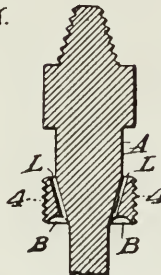
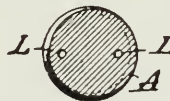


Fig. 4



Witnesses

M. E. Wilkinson

N. H. Robbins

Inventor

Walter Duncan

by

Harold V. Thompson
Attorneys

UNITED STATES PATENT OFFICE.

WALTER DUNCAN, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO ANTHONY H. HEDLEY, OF SAME PLACE.

UNDERREAMER.

SPECIFICATION forming part of Letters Patent No. 662,895, dated November 27, 1900.

Application filed April 4, 1900. Serial No. 11,547. (No model.)

To all whom it may concern:

Be it known that I, WALTER DUNCAN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Underreamers, of which the following is a specification.

My invention relates to improvements in reamers for enlarging a well-hole; and the objects of my improvements are, first, to provide a reamer that will enlarge the well-hole below the casing when necessary, and, second, to provide a reamer which will straighten the hole in case the drill gets the hole out of perpendicular. I attain these objects by the mechanism described herein and illustrated in the accompanying drawings, forming a part hereof, in which—

Figure 1 is a side view, partly in section and partly in elevation, of my reamer. Fig. 2 is a side view of the same on a plane at right angles to the plane of the view in Fig. 1. Fig. 3 is an enlarged longitudinal section of the upper part of the reamer-shaft. Fig. 4 is a cross-section on line 4 4 of Fig. 3.

A is the shaft or body of my reamer, the top of which is screw-threaded, so that it may be easily attached to the drill-stem, and in the bottom thereof is a screw-threaded socket whereby any suitable well-boring tool may be attached to the reamer when desired. The upper and lower portions of the body are preferably circular and of a size to snugly fit within the casing of the well being drilled, and thereby provide a suitable guide to keep the reamer perpendicular.

In each side of the lower part of the upper circular portion of the body are two semi-circular grooves B, one on each side thereof, to provide a bearing for the upper ends of cutters C, below which, as shown in Fig. 1, the body A is reduced in size for a short distance to provide clearance for the cutters C when the reamer is passing through the casing. The upper ends of the cutters fit into the grooves B. Near the upper ends of cutters C are holes D, through which and through hole E in body A and registering therewith when cutters C are in position passes pin F, which, with collar G, which screws onto body A and passes down over the

upper portion of the cutters, holds the cutters C in position attached to body A. Pin F has a loose fit in the cutters C and a tight fit in the body A and is kept in position by collar G. In the lower portion of cutters C and on the inner side thereof are sockets H for the reception of spiral spring I, which is seated therein and which passes through hole J in body A and keeps the cutters expanded when underreaming. It will be seen that when underreaming there is some little space K between the lower edge of the cutters C and body A and that this space increases until it practically runs out of the grooves B. This space under collar G might pack with debris if there were no upper outlet to the same. As drilling is always done with water in the hole, I provide channels which pass out of body A above collar G and furnish an outlet for the upper portion of space K, so that the debris may freely pass therethrough, and thereby avoid packing space K.

Around the lower edge of cutters C is a concave chamfer C' of such depth that when the cutters are pressed in against body A as the tool is passed down into the casing the cutters are expanded to contact with the casing the upper edge of chamfer C' will contact with the casing, while the lower or cutting edge thereof will not be in contact with the casing, thereby permitting the tool to slide down to the bottom of the casing, and when the bottom of the casing is passed the cutters are further expanded by spring H, that the lower or cutting edge of the chamfer C' will contact with the rock or dirt of the well-hole below the casing and as the tool is raised and lowered will cut the same until the hole is underreamed to the full size. The expansion of cutters C, which is only required to be a little in excess of the size of the casing that is being used in the hole in order that it may be pushed down more easily than if the dirt or rock touched the casing.

Having described my invention, what I claim is—

1. The herein-described underreamer, comprising the body A, provided with grooves on each side thereof, and holes E and therethrough, and channels L therein; and

662,895

rs C, one on each side of body A near the p thereof, said cutters having sockets H; d holes D therethrough, and chamfers C' the lower outer periphery thereof; spring adapted to fit in said sockets and pass rough hole J; pin F adapted to pass through les D in the cutters, and hole E in body A, d collar G adapted to screw on body A and ep pin F in position, and to keep cutters C om having too great expansion.

2. The herein-described underreamer, comprising a shaft, circular at the top and bottom d reduced in size intermediate the circular rtions, and having holes therethrough and annels therein, as shown; a groove in each le of the bottom of the upper circular portions; cutters having upper circular ends apted to fit in said grooves; said cutters vying holes extending through the upper

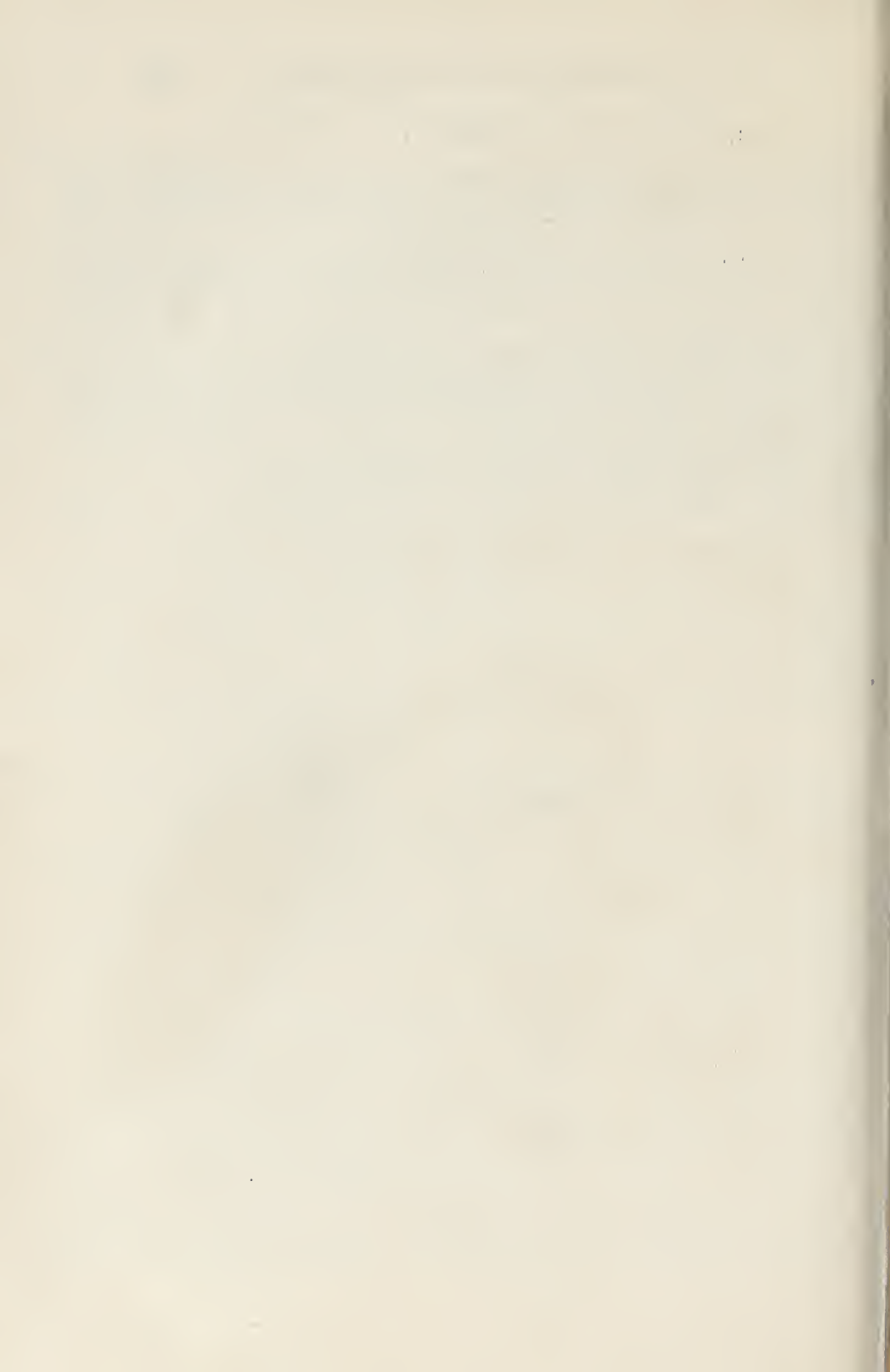
ends, and sockets in the lower ends on the 20 inner sides, and a chamfer around the outer lower edges thereof; a pin extending through a hole in the shaft and into the holes in the upper ends of said cutters; a spiral spring extending through a hole in the shaft, and hav- 25 ing its ends housed in the sockets in the lower ends of said cutters; and a collar adapted to be screwed onto the upper circular part of the shaft and to project over the upper portion of the cutters.

In witness that I claim the foregoing I have hereunto subscribed my name, this 28th day of March, 1900, at Los Angeles, California. 30

WALTER DUNCAN.

Witnesses:

M. C. WILKINSON,
G. E. HARPHAM.



Union Oil Tool Co.

547 MATEO STREET

Largest Manufacturers of Up-to-Date

Oil Well Drilling and
Fishing Tools

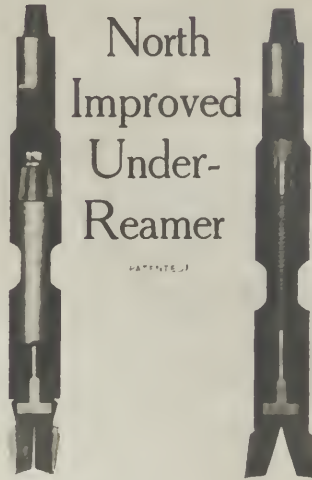
on the Pacific Coast.

OUR SPECIALTIES:

- Union Under-Reamers
- North Under-Reamers
- Union Ratchet Wire Rope Sockets
- Union Drilling Machines
- Union Wire Rope Knife
- Ideal Gas Engines, with reversible Clutch
- Pulleys for Cleaning Out and Pulling Rods and Tubing.
- Ideal Rig Irons

Ask Jobbers for "UNION" Tools They are
the Best on Earth.

Los Angeles California



North
Improved
Under-
Reamer

Manufactured by

Union Oil Tool Co.

547 Mateo St., Los Angeles, Cal.

Telephone South 26

Case No. 2996

U. S. Circuit Court of Appeals
For the Ninth Circuit

Union Oil Tool
Co's Circular of North Improved Underreamer
MAILED - 8 1917

U. S. Dist Ct, So. Dist. Cal. In Re
Union Tool Company et al. In Cont.
- vs -

Hilson & Hillard Mfg Co. #1546

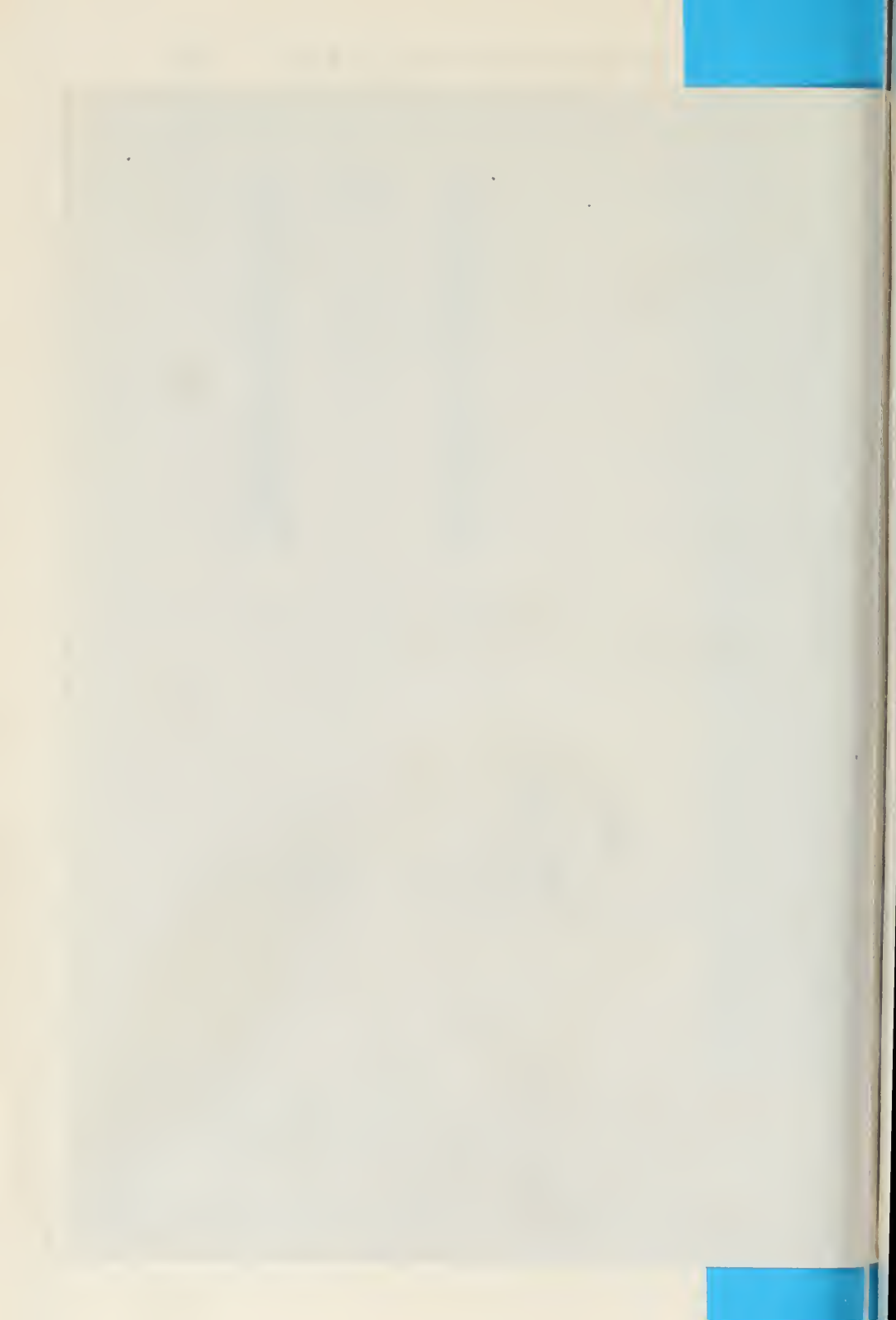
Defendants Exhibit Union Oil Tool
Company's Circular of North
Improved Underreamer

Leo Longley
Special Examiner

FILED
APR 16 1913

Wm. Van Dyke, Clerk
Deputy Clerk

161



**Defendant's Exhibit Certified File Wrapper and
Contents Double Patent in Suit.**

Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk.
By Chas. N. Williams, Deputy Clerk.

UNITED STATES OF AMERICA,
DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

To all to whom these presents shall come, Greeting :

THIS IS TO CERTIFY that the annexed is a
true copy from the Records of this Office of the File
Wrapper and Contents in the matter of the

Letters Patent of

Edward Double,

Number 734,833, Granted July 28, 1903,
for

Improvement in Underreamers.

IN TESTIMONY WHEREOF I have hereunto
set my hand and caused the seal of the Patent Office
to be affixed at the City of Washington, this 24th
day of October, in the year of our Lord one thousand
nine hundred and twelve and of the Independence
of the United States of America the one hundred and
thirty-seventh.

[Seal]

C. C. BILLINGS,
Acting Commissioner of Patents.

DIV. 38.

NUMBER (SERIES OF 1900).

80,144

1901

DIV. 25 38

Div'n. ~~XXV.~~ (EX'R'S. BOOK). 25-39

PATENT No. 734,833

Name—Edward Double

190 of Santa Paula,

County of

State of California,

Invention—Under-Reamer.

Division of App., No. , filed
PARTS OF APPLICATION FILED.

ORIGINAL.

RENEWED.

Petition	Oct. 26, 1901	, 190
Affidavit	" " 1901	, 190
Specification	" " 1901	, 190
Drawing—2 shts.	" " 1901	, 190
Model or Specimen	None	, 190
First Fee—Cash		, 190
" " Cert. \$15	Oct. 26	, 1901
Appl. filed complete	" 26	, 1901

Examined—A. P. Shaw, Ex. Jan. 2, 1903 , 190

Countersigned—J. W. Babson , 190

1-3-1903 For Commissioner. For Commissioner. July 8, 1903

Notice of Allowance—January 5 , 1903 , 190

Final Fee Cash Cert. dated July 3 , 1903 , 190

" " Cert. \$20 July 8 , 1903 , 190

3 Patented July 28 , 1903

Associate Attorney Attorney—Townsend Bros.,

Potomac Block,

2

Bradbury Block,

Los Angeles, Cal.

Name

Serial Number

Patent No.

Date of Patent

CERTIFICATE.

AMOUNT RECEIVED.

\$15.00.

CHIEF CLERK.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend, Francis M. Townsend.
321-322-323-324 Potomac Block (Opposite City
Hall) Broadway.

Edward Double,
Under Reamer.

Los Angeles, Cal., Oct. 21, 1901. 189
Commissioner of Patents.

Sir: We herewith enclose Petition and Power of Attorney, Specification, Oath, and 2 sheets of Drawings in the matter of the above-mentioned Application for Patent. Also U. S. Certificate of Deposit covering \$15.00 filing fee.

Very respectfully,

TOWNSEND BROS.

Mail Room. Oct. 26, 1901. U. S. Patent Office.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

James R. Townsend, Francis M. Townsend.

Potomac

OFFICE, 9 ~~DOWNEY~~ BLOCK.

Los Angeles, California.

PETITION AND POWER OF ATTORNEY.

TO THE HON. COMMISSIONER OF PATENTS.

Your petitioner Edward Double, whose postoffice address is Santa Paula, California, citizen of the United States residing at Santa Paula in the county of Ventura and State of California, prays that letters patent may be granted to himself for the ~~improvement in~~ Underreamer set forth in the annexed specification, and he hereby appoints the firm of TOWNSEND BROS., the individual members of which firm are James R. Townsend, ~~Alfred I. Townsend~~ and Francis M. Townsend of Los Angeles, California, his attorneys, with full power of substitution and revocation to prosecute this application, to make alterations and amendments therein, to receive the patent and to transact all business in the PATENT OFFICE connected therewith.

EDWARD DOUBLE.

SPECIFICATION.

To All Whom it May Concern.

Be it known that I, Edward Double, a citizen of the United States, residing at Santa Paula, in the

county of Ventura and State of California, have invented a new and useful UNDERREAMER, of which the following is a specification.

An object of this invention is to provide an underreamer which is easily constructed, effective in action and will not be liable to any breakage or loss of parts while in operation.

My invention includes the novel underreamer and the combinations and parts hereinafter described and claimed, and is capable of being carried out in various ways.

The accompanying drawings illustrate my invention.

Figure I is a view partly in vertical mid-section of an underreamer in operation below a well-casing, a portion of which is shown.

Fig. II is a plan of the lower end of the underreamer with the slips in the position shown in Fig I.

Fig. III is a view of an underreamer with parts in position for passing through the casing. Portions are shown in vertical mid-section. A fragment of the casing is shown in axial section.

Fig. IV is an elevation of the underreamer intact viewed from the right of Fig. III.

Fig. V is an elevation of the underreamer mandrel viewed from the right of Fig. IV ; portions being broken away to expose the ^{inner} construction of the lower part of the mandrel.

Fig. VI is an enlarged plan of the lower end of the underreamer mandrel, inverted.

Figs. VII and VIII are sections on lines indicated by VII and VIII, respectively, in Fig. I, looking in

the directions of the arrows, respectively.

Fig. IX is an enlarged mid-sectional detail to illustrate the manner of applying or taking off the slips.

Figs. X, XI and XII illustrate one of the slips from different points of view.

a designates a hollow mandrel desirably constructed of a hollow body 1 and a joint member 2 screwed thereon; the hollow body 1 being furnished at its upper end with a screw-threaded pin 3 to screw into the socket 4 in the lower end of the joint member 2. The hollow mandrel is furnished with an internal shoulder 5, ^{with oppositely arranged parallel bearing faces} a downward extension 6, *A* having a key-way 7 therein, shoulders 8 at the sides of such extension, and upwardly and inwardly sloping tapering dovetail slip-ways 9 beneath said shoulders. 10 designates a spring on the shoulder 5 in the hollow mandrel. 11 designates a rod playing up and down in the mandrel and furnished with a key-seat 12 and supported by the spring 10. Preferably the rod 11 is furnished with a nut 13 screwed on its upper end to be upheld by the spring 10. 14 designates a washer between the nut and the spring. 15 designates

per A

per B

^{tilt}
nates ~~dovetail~~ *A* slips slidingly connected with the mandrel and playing in the slip-ways 9 and furnished with key-seats 16, respectively. 17 designates a key in the key-seats of the slips and rod and playing in the key-way 7 of said extension and upheld by the spring-supported rod 11 to hold the slips against the shoulders 8. *A* Said slips are furnished with inward projections 18 to slide upon the downward extension 6 of the mandrel to spread apart the cutting

Insert B¹

B¹

edges 19 of the slips when the slips are drawn up. The slips 15 are slidingly mounted on opposite sides of the downwardly-extending portion of the mandrel and the key-seats 16 thereof are on the inner faces of the slips respectively and are practically closed at their outer ends, thus to exclude any mud or other foreign materials when the underreamer is in operation. 20 designates small holes in the slips respectively to allow a punch 21 to be inserted for adjusting the key in the operation of applying or taking off the slips. The key is preferably a notched key, being provided in its lower edge with a notch 22, so that when the key is in place in its seat 12 the ^{walls of the} A notch will engage the rod 11, thus to guard against displacement of the key from the position shown in Figs. I and III. The spring 10 affords yielding means for constantly holding the rod 11 up in the notch 22 and to hold the slips 15 against the shoulders 8; the parts of the underreamer being constructed to allow the key to be inserted through the rod 11 into the key-seat of a slip only when the slips and rod are drawn down with the key-seat 12 of the rod flush with the bottom of the key-way 7 in the mandrel. For this purpose the tapering dove-^{plane of the} tail slip-ways 9 open laterally just above the A lower end of the bottom of the key-way 7 in the extension to allow the key 17 to be inserted in the key-seats 12 and 20 only when said seats are flush with the lower end of the key-way 7 and the slip drawn out, as far sideways as it can be drawn, as shown in Fig. IX.

To assemble the parts of the underreamer, in the

first instance, the hollow body 1 being unscrewed from the joint member 2, the spring 10 will be inserted into the chamber 23 of the mandrel to rest on the shoulder 5 therein and the slip-carrying rod 11 will be inserted into place and the washer 14 and nut 13 adjusted, as shown in Fig. I. The nut is preferably held from unscrewing by means of a cotter-pin 24 passed through the rod 11 after the nut has been screwed home. The rod is then forced or pulled downward by any suitable means into the position shown in Fig. IX, thus bringing the bottom of the key-seat 12 flush with the bottom of the slot 7 in the extension 6 of the mandrel; then one of the slips is applied in position with its key-seat 16 ready to receive the key 17 when the same is inserted through the key-seat 12 and the slot 7; then the key is inserted and is passed through the key-seat of the rod sufficiently far to allow the other slip to be brought into position so that the key may be pushed back into the key-seat of said other slip; then a suitable instrument, such as the punch 21, will be inserted through the hole 20 and the key will be pushed back into the key-seat of the slip last applied, whereupon the notch 22 will be brought into position to receive the lower wall of the key-seat 12; then the rod 11 is released, thus allowing the yielding means 10 to draw the rod up into the mandrel, thus bringing the slips 15 up against the shoulders 8 and the inward projections 18 against the sides of the downward extension 6, thereby spreading apart the lower ends of the slips.

The face 25 of the lower end of the downward ex-

tension 6 of the mandrel is upwardly sloping at its edges and the upper faces 26 of the extensions are downwardly sloping so that when the slips are drawn upward they are readily forced outward by the sliding contact of the sloping faces 25 and 26.

By the construction shown wherein the hollow mandrel is provided at its upper end with a pin screwed into the lower end of the joint member 2, great strength of the hollow mandrel is insured.

In Fig. I, *b* designates the well-casing, and *c*, the usual shoe at the bottom of such casing.

In order to conveniently remove and re-apply the slips for the purpose of sharpening, or for any other purpose, the lower end of the rod 11 is furnished with a screw-threaded socket 27, and means for drawing down the rod against the pressure of the spring 10 are temporarily screwed into the socket to enable the operator to bring the rod 11 into position to allow the slips to be removed and replaced without unscrewing the body of the mandrel from the joint member.

The eye-bolt 28 shown in Fig. IX indicates a form of such means.

To remove the slips, the rod will be drawn down into the position shown in Fig. IX, thus bringing the key against the lower end of the key-way 7 in the extension 6 and allowing the rod to be drawn out of engagement with the notched edge of the key 17, whereupon a suitable instrument, such as the punch 21, will be inserted into the hole 20, and the key driven into the position substantially shown in Fig. IX, thus releasing one of the slips, whereupon the

punch 21 will be inserted into the hole 20 in the other slip and the key will be driven out of the key-seat 16 in said other slip, thereby releasing the other slip.

To replace the slips, the operation just described will be reversed.

When the slips have been replaced, the rod will be released and the eye-bolt unscrewed and the apparatus is ready for use.

29 designates the dovetail flanges of the slips to play in the ways 9.

To introduce the under-reamer into the well-cas-
 ing, the slips will be ^{tilted and} Λ drawn down into the position
 shown in Fig. III, thus bringing the projections 18
 below the extension 6, whereupon the edges 19 are
 brought toward each other sufficiently to allow the
 tool to pass down through the casing, and when the
 slips escape below the shoe *c*, the spring 10 draws
 up the rod 11 which tilts the slips
 Λ ~~the parts~~ into cutting position, as indicated in Fig.
 I. When the tool is drawn upward, the slips coming
 into contact with the shoe, will be ^{tilted and} Λ pressed into the
 position shown in Fig. III and will readily pass out
 through the casing.

What I claim and desire to secure by letters patent
 of the United States is:—

1. An under-reamer comprising a hollow man-
 drel furnished with an internal shoulder, a down-
 ward extension Λ ^{having opposite parallel bearing faces} having a key-way therein, shoul-
 ders at the sides of such extension, and upwardly and
 inwardly sloping dovetail slip-ways beneath said
 shoulders; a spring on the shoulder in the hollow

mandrel; a rod playing in the mandrel furnished with a key-seat and supported by the spring; dove-
^{tilt}tail \wedge slips playing in the slip-ways and furnished with key-seats respectively; a key in the key-seats of the slips and rod and playing in the key-way of said extension to hold the slips against the shoulders; said slips being furnished with inward projections to slide upon the downward extension of the mandrel to spread apart to cutting edges of the slips when the slips are drawn up.

2. An under-reamer furnished with a mandrel
^{provided with opposite parallel bearing faces} having a downward extension \wedge and a key-way in the extension; a spring-supported rod furnished with a
^{tilt}key-seat and playing up and down in the mandrel; \wedge slips slidingly connected with the mandrel and fur-
^{opposite bearing faces of the}nished with inward projections to slide upon the \wedge downward extension to spread the slips apart at the lower ends when the slips are drawn up; and a key carried by the rod and carrying the slips.

3. In an under-reamer, the combination of a mandrel; slips slidingly mounted on opposite sides of a portion of said mandrel and furnished on their inner faces respectively with key-seats; \wedge a yieldingly sup-
^{B²}ported rod playing lengthwise of the mandrel and furnished with a key-seat; and a notched key in the key-seats of the rod and slips. \wedge
^{A²}

4. A mandrel furnished with shoulders and a slotted extension beyond said shoulders and with dovetail ways on opposite sides of said extension;

per C

tilt

dovetail \wedge slips for said ways furnished on their inner faces respectively with key-seats; a rod sliding in said mandrel and furnished with a key-seat; a

per A

a portion of said rod taking into the notch of said key

notched key in the key-seats of the slips and rod; \wedge and yielding means to draw the rod up; the parts being constructed to allow the key to be inserted through the rod into the key-seat of a slip only when the slip and rod are drawn down with the key-seats thereof flush with the bottom of the key-way in the mandrel.

per A

tilt

5. In an under-reamer, dovetail \wedge slips furnished with key-seats respectively on their inner faces; a rod furnished with a key-seat; a key for said key-seats; a mandrel in which the rod plays constructed with a slotted extension and tapering dovetail slip-ways which open laterally just above the lower end of the bottom of the slot in the extension, to allow the key to be inserted in the slot and key-seats only when the key-seats are flush with the lower end of the slot.

per A

tilt slips

6. ~~An under-reamer furnished with a hollow mandrel \wedge ; a slip-carrying rod in said mandrel; means to yieldingly draw the rod into the mandrel; and a detachable member screwed into the end of the rod to draw the rod out for the purpose of applying and taking off the slips.~~

Cancelled
per B

per A

tilt

6 7. In an under-reamer, a mandrel furnished with a hollow slotted extension, the lower end of which slopes upward at the edges; \wedge slips slidingly con-

nected with the mandrel and furnished on their inner faces with projections, the upper faces of which slope downward to slide upon the extension of the mandrel; and means connecting the slips with the rod.

8. The under-reamer slip furnished on its inner face with a key-seat, and also furnished with a hole to insert a punch to adjust a key.

9. An under-reamer mandrel comprising a joint member having a screw threaded socket at its lower end and a mandrel-body having a screw-threaded pin at its upper end, and shoulders and an extension A at its lower end; and ways on the opposite side of said extension.

10. The dovetailed under-reamer slip furnished on its inner face with a projection 18, and also with a key-seat 16 and with a hole 20 opening thereinto.

IN TESTIMONY WHEREOF I have signed my name to this specification, in the presence of two subscribing witnesses, at Santa Paula, in the County of Ventura and State of California, this 19th day of October, 1901.

Inventor:

EDWARD DOUBLE.

Witnesses:

WALTER WEEKLEY.

W. F. DINGER.

OATH.

STATE OF CALIFORNIA,

VENTURA

COUNTY OF ~~LOS ANGELES~~,—ss.

Edward Double, the above-named petitioner, being duly sworn (or affirmed) deposes and says that he verily believes himself to be the original, first and sole inventor or discoverer of the ~~improvement in~~ Under Reamer described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof; or patented or described in any printed publication in any country before his invention or discovery thereof or more than two years prior to this application; or in public use or on sale in the United States for more than two years prior to this application, and that no application for patent on said improvement has been filed by him ^{legal representatives or assigns} or his ~~representatives~~ in any foreign country.

And said Edward Double states that he is a citizen of the United States and resident of Santa Paula in the County of Ventura and State of California.

EDWARD DOUBLE.

Sworn to and subscribed before me this 19th day of October, 1901,

[Seal]

ROBT. M. CLARKE,

Notary Public in and for the County of Ventura
~~Los Angeles~~, State of California.

Serial No. 80,144 Paper No. 1/2

MAIL ROOM

APPLICATION

OCT. 26, 1901

Filed Oct. 26, 1901.

U. S. PATENT OFFICE

E. Double.

TOWNSEND BROS.

Registered Attorneys.

MAILED

OCT. 28, 1901

No. 370.

Townsend Bros.

IN THE UNITED STATES PATENT OFFICE

James R. Townsend,

Francis M. Townsend

Edward Double,

Under Reamer, 80,144

Application sworn Oct. 19, 1901.

Filed

S No.

Los Angeles, Cal.,

Oct. 23, 1901. 190

Dated

No.

Commissioner of Patents,

Sir: In sheet 1 of the drawings, please change the numbering of the Figure immediately under Fig. I to be Fig. II, instead of Fig. III, as it erroneously appears on the drawings.

Very respectfully,

TOWNSEND BROS.,

Attorneys for Double.

JRT.—W.

Serial No. 80,144, Paper No. 1 Letter to Office.

Filed Nov. 2, 1901. E. Double. Mail Room.

Nov. 2, 1901. U. S. Patent Office.

A. B. S.

Paper No. —

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. —, Room No. 243.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR.

UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., Dec. 14, 1901.

MAILED “ “ “

Edward Double,

Care Townsend Bros.,

Potomac Block, Los Angeles, Cal.

Please find below a communication from the Examiner in charge of your application.

#80,144, filed Oct. 26, 1901, for Under-Reamer.

F. I. ALLEN,

Commissioner of Patents.

Claims 1, 2, 3, 4, and 5 are rejected as involving the mere double use of the slips and slip adjusting devices of either of the following patents, namely: 479,933, Carruthers, Aug. 2, 1892; 492,371, Mack, Feb. 21, 1893, and 563,054, Palm, June 30, 1896—Artesian & Oil, Wells; Tube Clamps.

Claims 6 and 7 are rejected in view of 679,384, Kellerman, July 30, 1901—Artesian & Oil, Wells; Reamers.

The 8th claim represents a mere fragment of an

operative device. It is rejected, however, in view of 492,371, Mack, cited above; also in view of 647,605, Mentry, Apr. 17, 1900—Artesian & Oil Wells; Reamers.

Claim 9 is rejected on Mentry, above cited; also in view of 439,275, Hobart et al., Oct. 28, 1890—same sub-class.

The 10th claim is also for an unpatentable fragment, and is rejected on the references cited for the 8th claim.

LEWIS B. WYNNE,

Examiner,

A. McN.

Division XXV.

Serial No. 80,144, Paper No. 2 Exrs. Letter Rejection. Dated Dec. 14, 1901. Double, E.

Room 243

80,144, Paper No. 2

Div. 25.

Amdt. A.

TOWNSEND BROS.

Registered Attorneys.

430-431-432-433 BRADBURY BLOCK, 304-306 S.

Broadway.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

MAILED

SEP. 16, 1902.

Townsend Bros.

PATENT OFFICE

SEP. 23, 1902

DIVISION XXV.

James R. Townsend,

Francis M. Townsend.

Edward Double.

Under-Reamer.

Los Angeles, Cal., Sept. 13, 1902. 190

Filed Oct. 26, 1901. S No. 80,144.

DatedNo.

Hon. Commissioner of Patents,

Sir: Examiner's letter of Dec. 14, 1901, has been considered.

We amend the specifications as follows: Page 2,
line 8, after the numeral "6" insert— with oppositely
arranged parallel bearing faces—. Page 5, line 9
from the bottom, after "be" insert— tilted and —.
Same page, line 5 from the bottom, cancel "the parts"
and substitute — up the rod 11 which tilts the
slips —. Same page, line 2 from the bottom, after
"be" insert — tilted and —. Same page after the
last paragraph, insert: —

A¹

— The rounded end 25 of the extension 6 when pressed against the abrupt projections 18 causes a quick tilting of the slips to throw their cutting edges outwardly and the slips are thus brought into position with a comparatively slight longitudinal movement. —

Claim 1, line 2, after "extension" insert — having
opposite parallel bearing faces —.

Claim 2, line 2, after "extension" insert — pro-
vided with opposite parallel bearing faces, —. Same

claim, line 5, after "the" insert — opposite bearing
faces of the —.

Claim 3, after the last word "slips" change the
period to a comma and add — a portion of said rod
taking into the notch of said key. —.

Claim 4, line 6, after "rod;" insert — a portion
into
of said rod taking \wedge the notch of said key,—.

Claim 5, line 1, after "dovetail" insert — tilt —.

Claim 6, line 1, after "mandrel;" insert — tilt
slips; —.

Claim 7, line 3, after "edges;" insert — tilt —.

Claim 9, line 4, after "extension" insert — with
opposite parallel bearing faces —.

Cancel claims 8 and 10 and substitute:

—8. In an under-reamer the combination of a
hollow mandrel, a slip-carrying rod in said man-
drel, slips connected to said rod, and means for tilting
said slips.

~~10.~~ 8. In an under-reamer the combination of a
hollow mandrel with a hollow slotted extension, said
extension having opposite parallel bearing faces, a
slip carrying rod in said mandrel, slips connected to
said rod, said slips having projections which bear
against said extension, said slips being provided with
key-seats, a key carried by said rod, each end of the

key lying in a key-seat of a slip, and the key-seat in each slip being somewhat larger than the key to allow the slips to partake of a tilting action. —

None of the references cited seem to show slips which partake of a tilting action. The slips in applicant's invention have a tilting action and by reason thereof they are quickly brought into position with a very slight longitudinal movement and with little lost motion of any of the parts. Neither do any of the references show a downward extension provided with opposite parallel bearing faces nor do they show slips provided with projections on their inner faces to co-operate with a downward extension provided with parallel bearing faces.

The claims have been amended to bring out these features and it is thought that the case is now in condition for allowance and such action is respectfully requested.

Very respectfully,
TOWNSEND BROS.,
Attys. for Double.

JRT.A.

M.

G. T. HACKLEY.

Mail Room. Sep. 22, 1902. U. S. Patent Office.
U. S. Patent Office, Sep. 23, 1902. Division 38.

L. C.

Paper No. 4.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Div. —, Room 222.

Address only

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

WASHINGTON, D. C., October 24, 1902.

MAILED “ “ “

Edward Double,
Care Townsend Brothers,
Potomac Block,
Los Angeles, California.

Please find below a communication from the EXAMINER in charge of your application for “Under-Reamer,” filed October 26, 1901, Serial No. 80,144.

F. I. ALLEN.

Commissioner of Patents.

In response to the communication filed September 22, 1902:

The phrase “tilt slips” used in claims 5, 6, and 7, is not explained in the specification. It should be specifically stated what element is referred to.

The last three lines of claim 10 should be more fully stated in the specification.

Claims 1 and 2 are rejected on patent to Swan,

683,352, September 24, 1901, (Artesian & Oil Wells, Reamers.)

Claims 3 and 4 are rejected on patent to Swan, cited, in view of patent to Meissner, 555,254, February 25, 1896, (Stone Working, Drills,) showing a key with a recess in it.

Claim 6 is rejected on patent to Palm, of record. It is common to screw handles on to articles to lift them as in lifting patterns out of molds. The addition of a handle is not invention in view of the construction shown in patent to Palm.

Claim 8 is rejected on patent to Brown, 687,296, November 26, 1901, (Artesian & Oil Wells, Reamers.)

Claim 9 appears incomplete as there is nothing to cooperate with parts specified. The elements appear in patents to Mentry and Brown, cited, and the claim is rejected.

Claims 5, 7, and 11, are as at present advised allowable, when the objections to them, noted above, are removed.

M. E. P.

G. R. IDE,
Actg. Exr.

MAILED

NOV. 28, 1902.

Townsend Bros.

ROOM 222

DIV. 38.

Paper #5

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

430-431-432-433 Bradbury Block,

304-306 S. Broadway.

James R. Townsend,

Francis M. Townsend

Edward Double

Under-Reamer.

Filed Oct. 26, 1901 S. No. 80,144.

Dated..... No.....

Los Angeles, Cal. Nov. 28, 1902. 190.

Commissioner of Patents,

Sir: Replying to the Office letter of Oct. 24, 1902,
we amend as follows:

Page 2, line 17, for "dovetail" substitute—tilt—.

Line 23, after "shoulders 8" insert.

The sockets or key-seats 16 are somewhat larger than the key 17 to permit the slips 15 to partake of a tilting action, the key 17 thus forming a portion, on the rod 11, on which the tilt slips or bits 15 are

loosely swung or pivoted, adapting their lower ends to tilt or swing in toward the center of the stock or mandrel portion to pass through the well-casing or to tilt away from the center to assume the proper position for reaming. The tilt-slips are provided with shoulders 18, adapted to slide upon a spreading portion provided in connection with the mandrel-body.

Claim 1, line 7, after "dovetail" insert—tilt—.

Claim 2, line 4 before "slips" insert—tilt—.

Claim 3, line 4, after "key-seats" insert—

said key-seats being somewhat larger than the key on the operating rod,—.

Cancel claim 6.

Renumber claim 7 as 6.

Substitute the following for claim 8, renumbering as claim 7.

—7. In an under-reamer, the combination with a hollow mandrel, provided with a slotted extension, a spring-actuated slip operating rod provided with a pivot key, tilt slips provided with key-seats adapted to be engaged by said pivot key, said key-seats being somewhat larger than the key to allow the slips to tilt, said slips provided with inwardly projecting shoulders, and said slotted extension provided with surfaces adapted to tilt said slips and hold the same in expanded position.—

Cancel claim 9.

Renumber claim 10 as 8.

—NOTE—

The specification has been amended to bring out clearly the meaning of the term “tilt” slips and to fully describe the action and results thereby secured.

Claims 1, 2 and 3 as amended clearly differentiate from Swan and as now submitted are allowable.

Claim 4 should be allowed. The patent to Swan does not show an equivalent for applicant's notched key and the patent to Meissner contains no suggestion of any use of such a notched key in an under-reamer or other device so that the key can be inserted through the rod into the key-seat of a slip only when the slip and rod are drawn down with the key-seats flush with the bottom of the mandrel. This construction effectuates a novel and advantageous construction and is not shown or suggested in either Swan or Meissner. The claim is submitted with full confidence of its allowance.

Claim 7 as rewritten is drawn for a combination of elements not found in any of the references cited nor in the prior art and is clearly allowable.

Claims 6 and 9 have been cancelled, the former as containing a combination not essential, the latter as being incomplete and for an inoperative combination.

The case ^{is} A now believed in condition for immediate allowance.

Early action is requested.

252 *Wilson & Willard Manufacturing Company*

Please change the address of applicant's Attorneys to be

430-3 Bradbury Block,
Los Angeles, Cal.

Very respectfully,

TOWNSEND BROS.,

Attys. for Double.

JRT.

FREDERICK S. LYON.

M.

Mail Room. Dec. 4, 1902. U. S. Patent Office.
U. S. Patent Office, Dec. 4, 1902. Division 38.

80,144. Paper No. 6.

Amdt. C.

TOWNSEND BROS,

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

430-431-432-433 Bradbury Block,
304-306 S. Broadway.

MAILED

TO PATENT OFFICE

DEC. 2, 1902.

Townsend Bros.

James R. Townsend,

Francis M. Townsend

ROOM 222.

DIV. 38.

Edward Double.

Under-Reamer.

Los Angeles, Cal. Dec. 2, 1902, 190

Filed Oct. 26, 1901, S. No. 80,144.

Dated No.

Commissioner of Patents,

Sir: Upon further consideration of this case,
after our amendment dated Nov. 28, 1902, we amend

as follows:

Claim 4, line 3, after "dovetail" insert—tilt—.

—NOTE—

It is requested that this application be considered
in connection with this amendment of claim 4 at the
same time that action is had upon the case as
amended by our letter of Nov. 28, 1902.

Very respectfully,

TOWNSEND BROS,

Attorneys for Double.

JRT.

FREDERICK S. LYON.

M.

Mail Room. Dec. 8, 1902. U. S. Patent Office.

U. S. Patent Office, Dec. 8, 1902. Division 38.

Serial No. 80,144.

Issue Division.

All communications should be addressed to

“The Commissioner of Patents,
Washington, D. C.”

DEPARTMENT OF THE INTERIOR,
U. S. PATENT OFFICE.

Washington, D. C., January 5, 1903.

Edward Double,

c/o Townsend Bros.

Potomac Block,

Los Angeles, Cal.

Sir:—Your APPLICATION for a patent for an
IMPROVEMENT IN

Under Reamers

Filed Oct. 26, 1901, has been examined and AL-
LOWED.

The final fee, Twenty Dollars, must be paid, and the Letters Patent bear date as of a day not later than SIX MONTHS from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The Office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least TWENTY DAYS prior to the conclusion of the six months allowed them by law. The printing, photolitho-

graphing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, **DISTINCTLY AND PLAINLY WRITTEN**, the name of the **INVENTOR** and **TITLE OF INVENTION AS ABOVE GIVEN**, **DATE OF ALLOWANCE** (which is the date of this circular), **DATE OF FILING**, and, if assigned, the **NAMES OF THE ASSIGNEES**.


If you desire to have the patent issue to **ASSIGNEES**, an assignment containing a **REQUEST** to that effect, together with the **FEE** for recording the same, must be filed in this Office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of 5 cents each. The money should accompany the order. Postage stamps will not be received.

Respectfully,


F. I. ALLEN,


Commissioner of Patents.

 After allowance, and prior to payment of the final fee, applicants should carefully scrutinize the description to see that their statements and language are correct, as mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after the

delivery of the letters patent to the patentee or his agent.

[Marginal Notes:]

 In remitting the final fee give the Serial Number at the head of this notice.

 If payment is made by check or draft, the credit allowed is subject to the collection of the same.

CERTIFICATE OF DEPOSIT.

\$20 RECEIVED

JUL. 8, 1903. J.

CHIEF CLERK, U. S. PATENT OFFICE.

MAILED

JUL. 3, 1903.

Townsend Bros.

TOWNSEND BROS.

Registered Attorneys.

No. 370.

IN THE UNITED STATES PATENT OFFICE.

321-322-323-324 Potomac Block, (Opposite City
Hall) Broadway.

James R. Townsend, Francis M. Townsend

Edward Double,

Under Reamer

Filed Oct. 26, 1901. S. No. 80,144.

Allowed Jan. 5, 1903. No.

Los Angeles, Cal., Jul. 3, 1903. 189.

Commissioner of Patents,

Sir: We herewith hand you U. S. Certificate of Deposit for \$20.00 final Government fee in the mat-

ter of the above-mentioned application. Please issue the patent as per record.

Very respectfully,

TOWNSEND BROS.

Serial No. 80,144.

Issue and Gazette Division.

All communications should be addressed to

"The Commissioner of Patents,
Washington, D. C."

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

Washington, D. C.,

July 8, 1903,

Edward Double,

c/o Townsend Bros.

Los Angeles, Cal.

SIR:

Your application for a patent for an IMPROVE-
MENT IN

Under-Reamers

filed Oct. 26, 1901, has been examined and again
ALLOWED.

The final fee, TWENTY DOLLARS, in the
above-entitled case was received July 8, 1903.

Very respectfully,

F. I. ALLEN,

Commissioner of Patents.

No. 734,833.

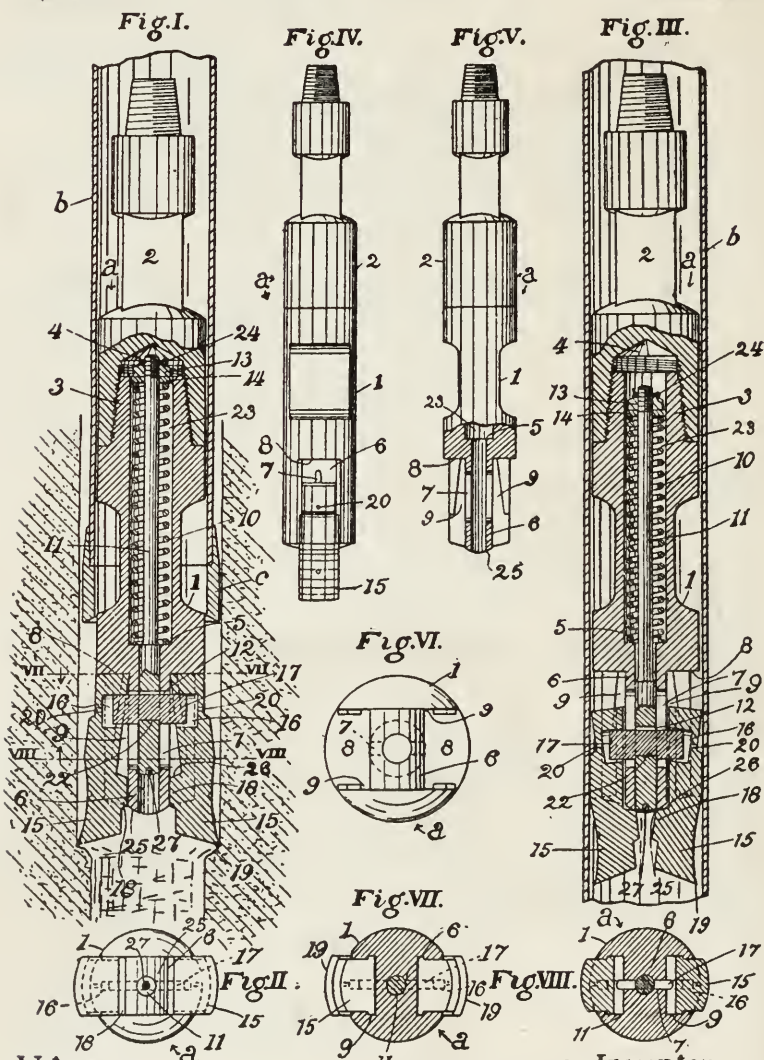
PATENTED JULY 28, 1903.

E. DOUBLE.
UNDERREAMER.

APPLICATION FILED OCT. 26, 1901.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses.
C. F. Riehy.
J. Townsend.

Inventor.
Edward Double
by Townsend Bros.
his attys.

No. 734,833.

PATENTED JULY 28, 1903.

E. DOUBLE.
UNDERREAMER.

APPLICATION FILED OCT. 20, 1901.

NO MODEL

1 SHEET-SHEET 2

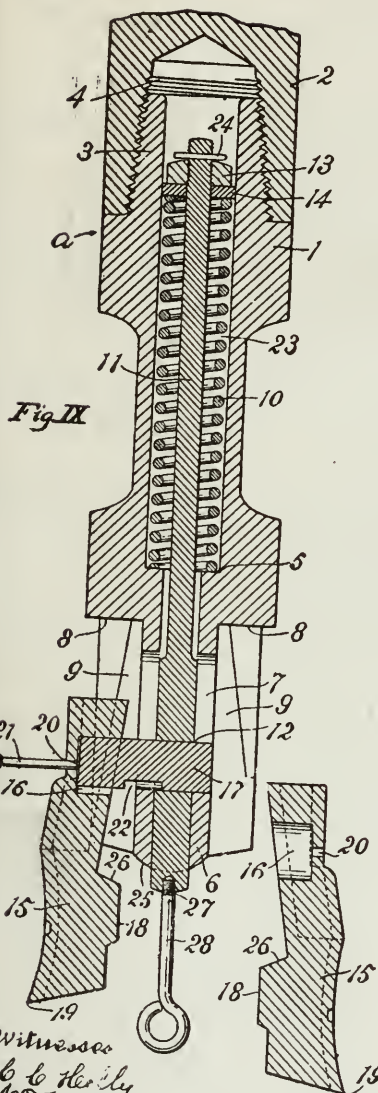


Fig X

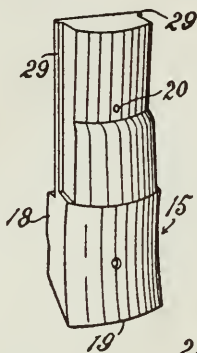


Fig XI

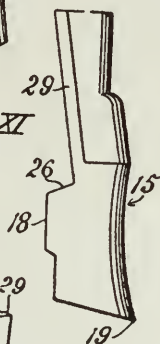
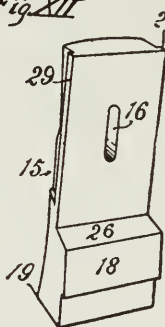


Fig XII



Witnesses
to the
J. Townsend.

Inventor
Edward Double
by Townsend Bros
his attys.

UNITED STATES PATENT OFFICE.

EDWARD DOUBLE, OF SANTA PAULA, CALIFORNIA.

UNDERREAMER.**SPECIFICATION** forming part of Letters Patent No. 734,833, dated July 28, 1903.

Application filed October 26, 1901. Serial No. 80,144. (No model.)

To all whom it may concern:

Be it known that I, EDWARD DOUBLE, a citizen of the United States, residing at Santa Paula, in the county of Ventura and State of California, have invented a new and useful Underreamer, of which the following is a specification.

An object of this invention is to provide an underreamer which is easily constructed, effective in action, and will not be liable to any breakage or loss of parts while in operation.

My invention includes the novel underreamer and the combinations and parts hereinafter described and claimed and is capable of being carried out in various ways.

The accompanying drawings illustrate my invention.

Figure I is a view partly in vertical mid-section of an underreamer in operation below a well-casing, a portion of which is shown. Fig. II is a plan of the lower end of the underreamer with the slips in the position shown in Fig. I. Fig. III is a view of an underreamer with parts in position for passing through the casing. Portions are shown in vertical mid-section. A fragment of the casing is shown in axial section. Fig. IV is an elevation of the underreamer intact viewed from the right of Fig. III. Fig. V is an elevation of the underreamer-mandrel viewed from the right of Fig. IV, portions being broken away to expose the inner construction of the lower part of the mandrel. Fig. VI is an enlarged plan of the lower end of the underreamer-mandrel inverted. Figs. VII and VIII are sections on lines indicated by VII and VIII, respectively, in Fig. I, looking in the directions of the arrows, respectively. Fig. IX is an enlarged mid-sectional detail to illustrate the manner of applying or taking off the slips. Figs. X, XI, and XII illustrate one of the slips from different points of view.

a designates a hollow mandrel desirably constructed of a hollow body 1 and a joint member 2 screwed thereon, the hollow body 1 being furnished at its upper end with a screw-threaded pin 3 to screw into the socket 4 in the lower end of the joint member 2. The hollow mandrel is furnished with an internal shoulder 5, a downward extension 6, with oppositely-arranged parallel bearing-faces having a keyway 7 therein, shoulders 8 at the

sides of such extension, and upwardly a inwardly sloping tapering dovetail slipway 9 beneath said shoulders.

10 designates a spring on the shoulder 5 the hollow mandrel.

11 designates a rod playing up an dov in the mandrel and furnished with a key-seat 12 and supported by the spring 10. Preferably the rod 11 is furnished with a nut screwed on its upper end, to be upheld by the spring 10.

14 designates a washer between the nut and the spring.

15 designates tilt-slips slidably connected with the mandrel and playing in the slipway 9 and furnished with key-seats 16, respectively.

17 designates a key in the key-seats of the slips and rod and playing in the keyway 7 said extension and upheld by the spring-supported rod 11 to hold the slips against the shoulders 8.

The sockets or key-seats 16 are somewhat larger than the key 17 to permit the slips to partake of a tilting action, the key 17 forming a portion on the rod 11, on which the tilt slips or bits 15 are loosely swung pivoted, adapting their lower ends to tilt swing in toward the center of the stock mandrel portion to pass through the well-casing or to tilt away from the center to assume the proper position for reaming. The tilt-slips are provided with shoulders adapted to slide upon a spreading portion provided in connection with the mandrel body. Said slips are furnished with inward projections 18 to slide upon the downward extension 6 of the mandrel to spread apart the cutting edges 19 of the slips when the slips are drawn up. The slips 15 are slidably mounted on opposite sides of the downwardly-extending portion of the mandrel, and the key-seats 16 thereof are on the inner faces of the slips, respectively, and are practically closed at their outer ends, thus to exclude any mud or other foreign materials when the underreamer is in operation.

20 designates small holes in the slips, respectively, to allow a punch 21 to be inserted for adjusting the key in the operation of applying or taking off the slips. The key preferably a notched key, being provided

734,833

ts lower edge with a notch 22, so that when the key is in place in its seat 12 the walls of the notch will engage the rod 11, thus to guard against displacement of the key from the position shown in Figs. I and III. The spring 10 affords yielding means for constantly holding the rod 11 up in the notch 22 and to hold the slips 15 against the shoulders, the parts of the underreamer being constructed to allow the key to be inserted through the rod 11 into the key-seat of a slip only when the slips and rod are drawn down with the key-seat 12 of the rod flush with the bottom of the keyway 7 in the mandrel. For this purpose the tapering dovetail slipways 9 open laterally just above the plane of the lower end of the bottom of the keyway 7 in the extension to allow the key 17 to be inserted in the key-seats 12 and 20 only when the seats are flush with the lower end of the keyway 7 and the slip drawn out as far sideways as it can be drawn, as shown in Fig. IX. To assemble the parts of the underreamer the first instance, the hollow body 1 being unscrewed from the joint member 2, the spring 10 will be inserted into the chamber 23 of the mandrel to rest on the shoulder 5 therein, and the slip-carrying rod 11 will be inserted into place and the washer 14 and nut 13 adjusted, as shown in Fig. I. The nut is preferably held from unscrewing by means of a cotter-pin 24 passed through the rod 11 after the nut has been screwed home. The rod is then freed or pulled downward by any suitable means into the position shown in Fig. IX, thus bringing the bottom of the key-seat 12 flush with the bottom of the slot 7 in the extension 6 of the mandrel. Then one of the slips is applied in position, with its key-seat 16 ready to receive the key 17, when the key is inserted through the key-seat 12 and the slot 7. Then the key is inserted and is pressed through the key-seat of the rod sufficiently far to allow the other slip to be brought to position, so that the key may be pushed back into the key-seat of said other slip. Then a suitable instrument, such as the punch 21, will be inserted through the hole 20 and the slip will be pushed back into the key seat of the slip last applied, whereupon the notch 22 will be brought into position to receive the lower wall of the key-seat 12. Then the rod 11 is released, thus allowing the yielding means 10 to draw the rod up into the mandrel, thus bringing the slips 15 up against the shoulders and the inward projections 18 against the faces of the downward extension 6, thereby separating apart the lower ends of the slips. The face 25 of the lower end of the downward extension 6 of the mandrel is upwardly sloping at its edges and the upper faces 26 of the extensions are downwardly sloping, so that when the slips are drawn upward they are readily forced outward by the sliding contact of the sloping faces 25 and 26. By the construction shown wherein the hollow mandrel is provided at its upper end with

a pin screwed into the lower end of the joint member 2 great strength of the hollow mandrel is insured.

In Fig. I, *b* designates the well-casing and *c* the usual shoe at the bottom of such casing.

In order to conveniently remove and reapply the slips for the purpose of sharpening or for any other purpose, the lower end of the rod 11 is furnished with a screw-threaded socket 27, and means for drawing down the rod against the pressure of the spring 10 are temporarily screwed into the socket to enable the operator to bring the rod 11 into position to allow the slips to be removed and replaced without unscrewing the body of the mandrel from the joint member.

The eyebolt 28 (shown in Fig. IX) indicates a form of such means.

To remove the slips, the rod will be drawn down into the position shown in Fig. IX, thus bringing the key against the lower end of the keyway 7 in the extension 6 and allowing the rod to be drawn out of engagement with the notched edge of the key 17, whereupon a suitable instrument, such as the punch 21, will be inserted into the hole 20 and the key driven into the position substantially shown in Fig. IX, thus releasing one of the slips, whereupon the punch 21 will be inserted into the hole 20 in the other slip and the key will be driven out of the key-seat 16 in said other slip, thereby releasing the other slip.

To replace the slips, the operation just described will be reversed.

When the slips have been replaced, the rod will be released and the eyebolt unscrewed and the apparatus is ready for use.

29 designates the dovetail flanges of the slips to play in the ways 9.

To introduce the underreamer into the well-casing, the slips will be tilted and drawn down into the position shown in Fig. III, thus bringing the projections 18 below the extension 6, whereupon the edges 19 are brought toward each other sufficiently to allow the tool to pass down through the casing, and when the slips escape below the shoe *c* the spring 10 draws up the rod 11, which tilts the slips into cutting position, as indicated in Fig. I. When the tool is drawn upward, the slips coming into contact with the shoe will be tilted and pressed into the position shown in Fig. III and will readily pass out through the casing.

The rounded end 25 of the extension 6 when pressed against the abrupt projections 18 causes a quick tilting of the slips to throw their cutting edges outwardly, and the slips are thus brought into position with a comparatively slight longitudinal movement.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. An underreamer comprising a hollow mandrel furnished with an internal shoulder, a downward extension having opposite parallel bearing-faces having a keyway therein, shoulders at the sides of such extension, and upwardly and inwardly sloping dovetail slip-

ways beneath said shoulders; a spring on the shoulder in the hollow mandrel; a rod playing in the mandrel furnished with a key-seat and supported by the spring; dovetail tilt-slips playing in the slipways and furnished with key-seats respectively; a key in the key-seats of the slips and rod and playing in the keyway of said extension to hold the slips against the shoulders; said slips being furnished with inward projections to slide upon the downward extension of the mandrel to spread apart the cutting edges of the slips when the slips are drawn up.

2. An underreamer furnished with a mandrel having a downward extension provided with opposite parallel bearing-faces and a keyway in the extension; a spring-supported rod furnished with a key-seat and playing up and down in the mandrel; tilt-slips slidingly connected with the mandrel and furnished with inward projections to slide upon the opposite bearing-faces of the downward extension to spread the slips apart at the lower ends when the slips are drawn up; and a key carried by the rod and carrying the slips.

3. In an underreamer, the combination of a mandrel; slips slidingly mounted on opposite sides of a portion of said mandrel and furnished on their inner faces respectively with key-seats, said key-seats being somewhat larger than the key on the operating-rod; a yieldingly-supported rod playing lengthwise of the mandrel and furnished with a key-seat; and a notched key in the key-seats of the rod and slips, a portion of said rod taking into the notch of said key.

4. A mandrel furnished with shoulders and a slotted extension beyond said shoulders and with dovetail ways on opposite sides of said extension; dovetail tilt-slips for said ways furnished on their inner faces respectively with key-seats; a rod sliding in said mandrel and furnished with a key-seat; a notched key in the key-seats of the slips and rod; a portion of said rod taking into the notch of said key, and yielding means to draw the rod up; the parts being constructed to allow the key to be inserted through the rod into the key-seat of a slip only when the slip and rod are drawn down with the key-seats thereof flush with the bottom of the keyway in the mandrel.

5. In an underreamer, dovetail tilt-slip furnished with key-seats respectively on their inner faces; a rod furnished with a key-seat a key for said key-seats; a mandrel in which the rod plays constructed with a slotted extension and tapering dovetail slipways which open laterally just above the lower end of the bottom of the slot in the extension, to allow the key to be inserted in the slot and key-seat only when the key-seats are flush with the lower end of the slot.

6. In an underreamer, a mandrel furnished with a hollow slotted extension, the lower end of which slopes upward at the edges; tilt-slips slidingly connected with the mandrel and furnished on their inner faces with projections the upper faces of which slope downward to slide upon the extension of the mandrel; and means connecting the slips with the rod.

7. In an underreamer, the combination with a hollow mandrel, provided with a slotted extension, a spring-actuated slip-operating rod provided with a pivot-key, tilt-slip provided with key-seats adapted to be engaged by said pivot-key, said key-seats being somewhat larger than the key to allow the slips to tilt, said slips provided with inwardly-projecting shoulders, and said slotted extension provided with surfaces adapted to tilt said slips and hold the same in expanded position.

8. In an underreamer the combination of a hollow mandrel with a hollow slotted extension, said extension having opposite parallel bearing-faces, a slip-carrying rod in said mandrel, slips connected to said rod, said slip having projections which bear against said extension, said slips being provided with key-seats, a key carried by said rod, each end of the key lying in a key-seat of a slip, and the key-seat in each slip being somewhat larger than the key to allow the slips to partake of tilting action.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Santa Paula, the county of Ventura and State of California, this 19th day of October, 1901.

EDWARD DOUBLE.

Witnesses:

WALTER WEEKLEY,
W. F. DINGER.

166. Artesian & Oil Wells.

6. Reamers.

1901

CONTENTS:

Print

Application papers. O. K.

1. Letter to Office Nov. 2, 1901.
2. Rej. Dec. 14, 1901.
3. Amdt. A. Sep. 22, '02.
4. Rej. Oct. 24, 1902.
5. Amdt. B. Dec. 4, '02.
6. Amdt. C. Dec. 8, '02.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
23. A. O. W. Reamers.

TITLE:

Improvement in Under Reamers.

[Endorsed]: U. S. Dist. Ct., So. Dist. Cal., So. Div. In Equity—#1540. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. Defendant's Exhibit File Wrapper and Contents Double Patent in Suit. Leo Longley, Special Examiner.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Certified File Wrapper and Contents Double Patent in Suit. Filed May 8, 1917. F. D. Monckton, Clerk.

Defendant's Exhibit U. S. Plotts Patent No. 668,340.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., So. Div. #1540—In Equity. Union Tool Company et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit U. S. Plotts Patent No. 668,340." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit U. S. Plotts Patent No. 668,340. Filed May 8, 1917. F. D. Monckton, Clerk.

No. 668,340.

Patented Feb. 19, 1901

W. PLOTTS.
REAMER FOR OIL OR LIKE WELLS.

(Application filed May 6, 1907.)

(No Model.)

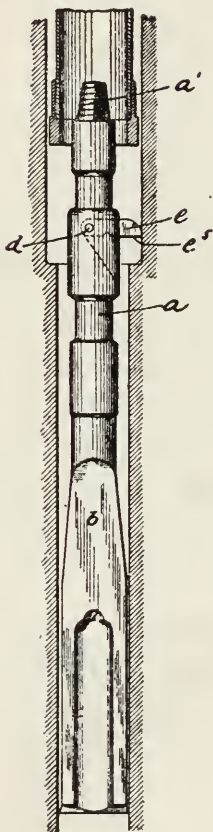


Fig. 1

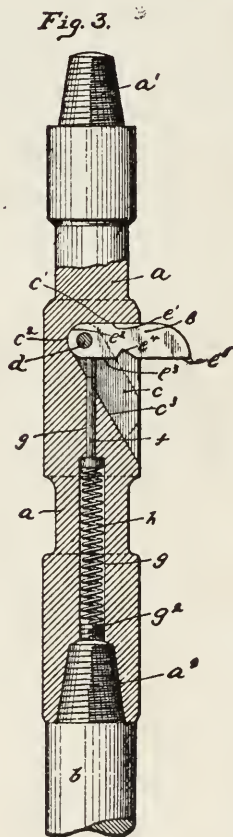


Fig. 3.

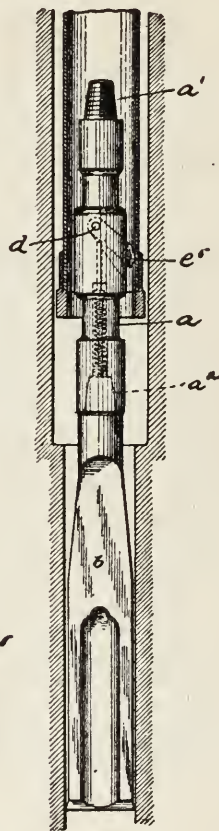


Fig. 2.

Witnesses

Walter Tammann
Robert C. Zottner

Inventor:

William Platts
By [Signature] Attorney

UNITED STATES PATENT OFFICE.

WILLIAM PLOTTS, OF McDONALD, PENNSYLVANIA.

REAMER FOR OIL OR LIKE WELLS.

SPECIFICATION forming part of Letters Patent No. 668,340, dated February 19, 1901.

Application filed May 6, 1897. Serial No. 635,351. (No model.)

to all whom it may concern:

Be it known that I, WILLIAM PLOTTS, a resident of McDonald, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Reamers for Oil and Like Wells; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to reamers for oil and like wells.

The invention has reference more particularly to that class of reamers generally known as "under" reamers, in which a cutter is employed which normally projects out beyond the body of the cutter, but which when passing through the casing is withdrawn, so as not to interfere with the passage of the reamer through the same. The difficulty heretofore in the use of this class of under reamers has been the liability of the breaking or bending of the pin on which the cutter is mounted when said cutter is subjected to the severe strains which they have to bear in the cutting of the rock. If the pin breaks and the cutter is detached and becomes lodged in the well, it may prevent the further drilling of the well.

The object of my invention is to provide a reamer with the cutting-knife so secured and protected against strains as to obviate the difficulty hereinbefore referred to.

To this end my invention comprises, generally stated, a reamer having formed in the body portion thereof a seat or recess, a cutter mounted on a pin in said seat, the inner end of said cutter abutting against the solid body of the reamer at the inner face of said seat and the outer end extending normally beyond said body, (in a horizontal position,) and spring mechanism for retaining said cutter in this position.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a view of my improved reamer in use in a well. Fig. 2 is a view showing the same passing through the casing. Fig. 3 is an enlarged longitudinal section of the reamer removed from the well.

Like letters of reference indicate like parts in each view.

The letter *a* represents the body of the reamer, having the ordinary threaded connection *a'* at its upper end and the threaded seat *a²* at its lower end, with which the bit *b* engages.

A seat or recess *c* is formed in the body *a* at a suitable point therein. This seat *c* is preferably formed, as illustrated, with the straight upper face *c'*, the curved rear face *c²*, and the inclined face *c³*.

Mounted on the pin *d* is the cutter *e*, said cutter having the straight upper edge *e'*, the curved rear edge *e²*, the lower edge *e³*, with the recess *e⁴* formed therein, and the outer cutting edge *e⁵*. When the cutter *e* is mounted on the pin *d* and held in its normal position, the upper edge *e'* will be in contact with the upper face *c'* of the seat *c*, the curved rear edge *e²* will abut against the curved rear face *c²*, while the cutting edge *e⁵* will extend beyond the body of the reamer.

In order to retain the cutter *e* in its normal position for cutting, a rod *f*, movable vertically in a seat *g* formed for it in the body *a*, has its upper end forced into contact with the lower edge *c³* of the cutter *e* by means of the spring *h*. This spring *h* fits in an enlarged portion *g'* of the seat *g* and presses against a head *f'* on said rod *f*, said spring being interposed between said head *f'* and the bottom of the seat *g'*, which consists of the plug *g²*. By the above construction the seat *g* is only of sufficient diameter to permit of the rod *f* moving freely therein, so that I do not weaken the body of the reamer so much as where the spring encircles the rod and necessitates a seat of the same size as the enlarged portion *g'* for its entire length.

The operation of my improved reamer is as follows: When the reamer is being lowered through the casing, the cutter *e* will have its outer or cutting edge *e⁵* moving in contact with the casing, and accordingly the cutter *e* will assume the position shown in Fig. 2. In this case the pressure brought to bear upon the cutter to lower same will also lower the rod *f* until the lower edge *e³* of said cutter comes in contact with the inclined face *c³* of the seat *c*, whereupon the upper end of the rod *f* will enter the recess *e⁴* in the cutter *e*. In this manner the reamer is lowered until it gets beyond the casing, as shown in Fig. 1,

whereupon the spring *h* forces up the rod *f* and the cutter *e* resumes its normal position within the seat *c*. The cutter then has its cutting edge *e*⁵, extending beyond the body of the reamer, in position to cut the rock below the lower end of the casing to permit of said casing being lowered. The reamer is raised and lowered in the ordinary manner of drilling, said reamer being also turned at each stroke. The cutter thus cuts under the casing in the manner illustrated.

The cutter may be used in connection with the drill-bit, as shown, or it may be used independently, if desired.

By having the cutter supported in the manner described, with its rear edge *e*² backed up by the solid body of the reamer, any tendency toward inward movement on the part of the cutter is resisted, so that there is practically no strain on the pin *d*. This prevents the bending or breaking of the pin *d* and the consequent displacement of the cutter or its complete detachment from the reamer. I have found by experience that the severest strains brought upon the cutter are those lateral or horizontal strains which come from the walls of the well. Consequently by my construction the cutter is braced and backed up in such a manner as to withstand these strains without injury.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a reamer for oil and like wells, the combination with a solid body portion having a recess formed therein and a pin projecting through the rear portion of the recess, said recess adjacent to the pin being concentric

therewith, of a cutter pivotally mounted on said pin and having a rear end that conforms to and closely fits the portion of the recess that is concentric with the pin, and a spring for holding said cutter normally up in a horizontal position, substantially as set forth.

2. In a reamer for oil and like wells, the combination with a solid body portion having a recess formed therein and a pin projecting through said recess, adjacent to the rear end thereof, the upper side of said recess being substantially perpendicular to the axis of the reamer-body and the rear portion being concentric with the pin, of a cutter having a rear end that closely fits the rear end of the recess, and a top edge that fits the upper side of the recess when in working position, and a spring for holding said cutter normally in a horizontal position, substantially as set forth.

3. In a reamer for oil and like wells, the combination with a solid body portion having a recess therein and a pin projecting through said recess adjacent to the rear end thereof, said rear end being concentric with the pin, of a cutter pivotally mounted on said pin and having a rear end that conforms to and closely fits the rear end of the recess, a vertically movable rod below said cutter, and a spring adapted to force said rod into engagement with said cutter, substantially as set forth.

In testimony whereof I, the said WILLIAM PLOTTS, have hereunto set my hand.

WILLIAM PLOTTS.

Witnesses:

ROBT. D. TOTTEN,
ROBERT C. TOTTEN.

UNDER REAMING AND DRILLING TOOLS.

MACK'S PATENT UNDER REAMER.

FIG. 1705.



Latch.

To enlarge the hole under the drive pipe or casing to the size of the shoe or couplings, so that the drive pipe or casing can be readily forced down.

FILED

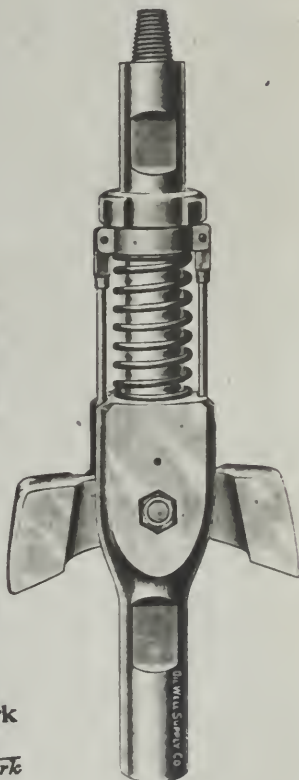
APR 16 1913

WM. M. VAN DYKE, Clerk
By *Chas. M. Williams*
Deputy Clerk

To enter the pipe, force the spring up until the tongue is relieved, when the reamers can be drawn together and remain so until the tool is below the pipe, when the spring will force the tongue between the reamers. When raising, the latch will strike against the end of the pipe and the spring will be forced up again.

RUSSIAN UNDER REAMER.

FIG. 1707.



To enter the pipe, force the reamers down, where they will remain until the tool is below the pipe, when they will spring out and remain so. When raising the tool, the reamers will be forced down by striking the end of the pipe.

A bit for drilling is attached to the bottom.

2996

U. S. Circuit Court of Appeals
For the Ninth Circuit

Page 80, Oil Well
Supply Co's Catalog of 1900.
MAY - 8 1917

Leo Longley
Special Hammer

270

OIL WELL SUPPLY COMPANY.

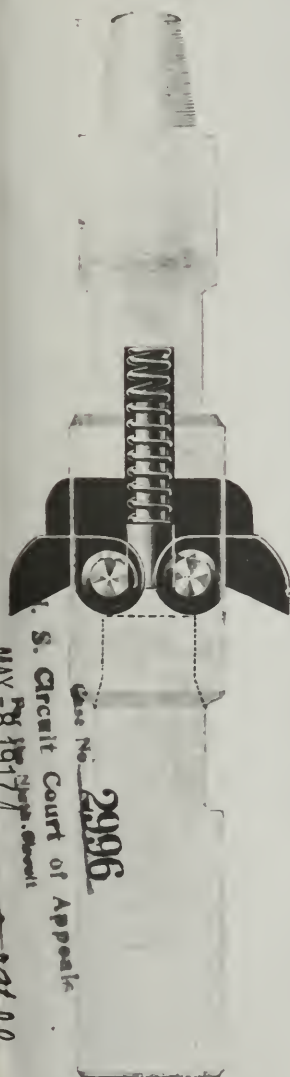
AUSTRIAN UNDER REAMER.

FIG. 1715.

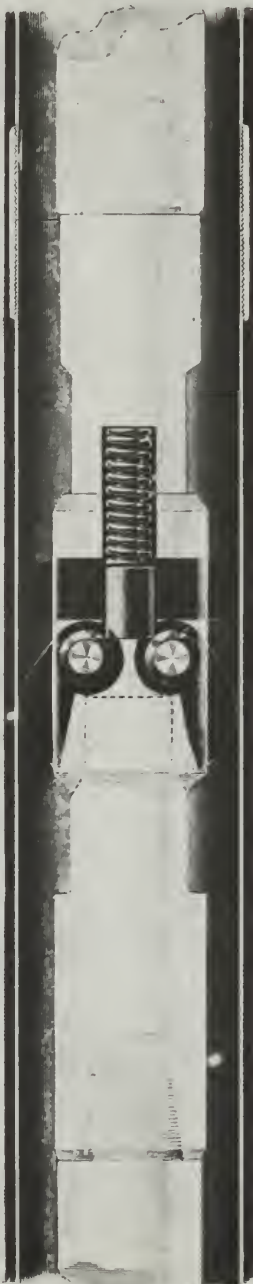
FIG. 1717.

COMPLETE.

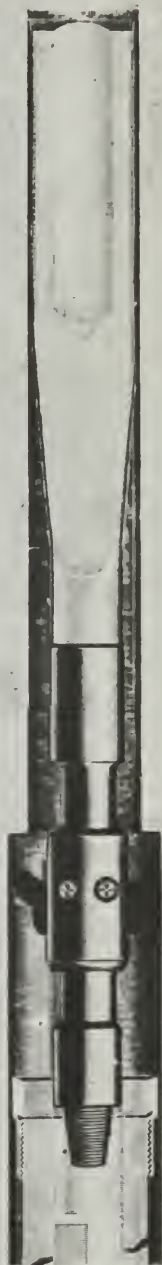
FIG. 1713.



When being lowered through the pipe.



Drive pipe.
 Shoe.
 Enlarged hole.



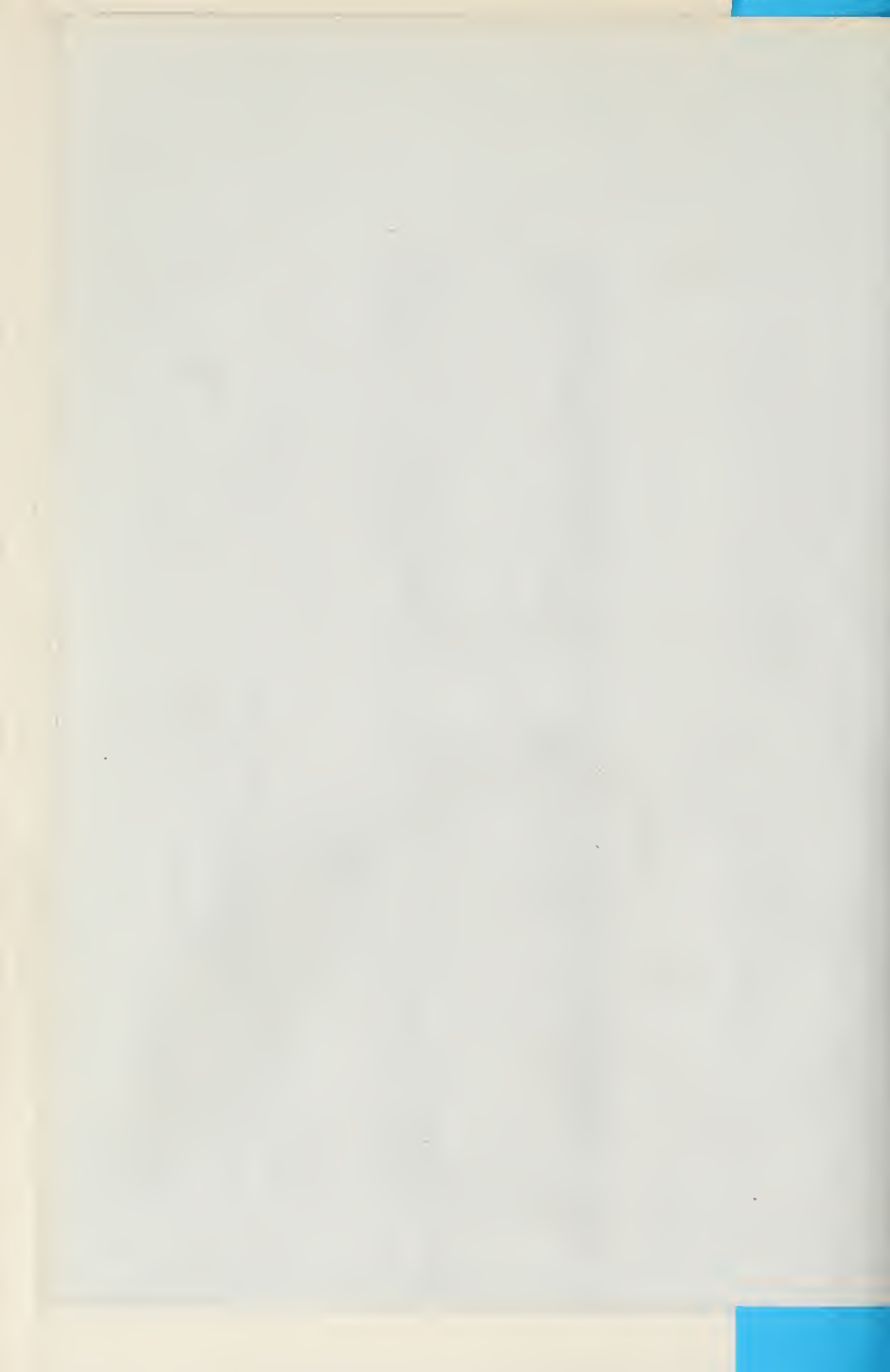
Bit drilling small hole ahead of reamer.

S. Circuit Court of Appeals
 MAY - 28 1917
 Case No. 2996

FILED

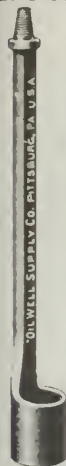
APR 16 1913

For drilling a hole in a pipe or casing, the reamer enlarging the hole sufficiently to allow the drive pipe or casing to sink freely. The drive pipe or casing is supported by stops, allowing enough space below shoe for the reamer to work without striking the bottom of the hole. The bit is screwed to the end of the reamer and makes a hole the size of the reamer and bit working in well. These are all phantom views.



ARTS OF THE CANADIAN POLE TOOL SYSTEM OF DRILLING WELLS.

ONE LEG
SOCKET.
G. 2153.



HALF TURN
SOCKET.

FIG. 2156.



TWO LEG
SOCKET.

FIG. 2159.



Has two dogs with
springs.

UNDER REAMER.

FIG. 2161.



See long leg, special examiner

FILED

APR 16 1913

M. VAN DYKE

By M. Van Dyke

2055.



BELL MOUTH DUTCHMAN

FIG. 2164.



For 5 3/8-inch casing.

2996

For 4 1/4-inch casing.

Case No.

U. S. Circuit Court of Appeals

For the Ninth Circuit

Fig 2164

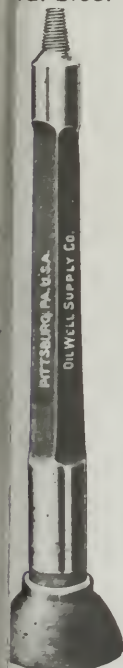
Supply Co's Catalog of 1900.

MAY - 8 1917

F. D. MORTON, Clerk

BELL MOUTH
DUTCHMAN.

FIG. 2163.



**Defendant's Exhibit Letter J. O. Dart to Edward
North of March 15, 1902.**

Coalinga, Calif., March 15, 1902.

Mr. Edw'd North,

Los Angeles, Calif.

Dear Sir:—

Regarding my use of your Under-reamer, I would say that I used it in this field to my perfect satisfaction. It is, by long odds the best under-reamer I have ever seen. I reamed about 125 ft with it, including three very hard shells (the last one being of a flinty character and about 4 ft thick) and had no difficulty in getting the casing down afterward, not being obliged to run the reamer a second time on any of the work. I ran this reamer (55 $\frac{5}{8}$ "") on a 31 $\frac{1}{2}$ "x32' stem in the third hole without damage, and did the work in much less time than I could have done it with any other reamer I have ever run.

Yours truly,

J. O. DART.

[Endorsed]: U. S. Dist. Court, So. Dist. Cal., So. Div. No. 1540. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit Letter, J. O. Dart to Edward North, of March 15, 1902." Leo. Longley, Special Examiner. Filed April 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Letter, J. O. Dart to Edward North, of March 15, 1902. Filed May 8, 1917. F. D. Monckton, Clerk.

**Defendant's Exhibit Letter of March 19, 1902,
Martin Barber to Edward North.**

SANTA FE.

The A. T. & S. F. Ry. Co. Sou. Cal. Ry. Co.
G. C. & S. F. Ry. Co. The S. F. & S. J. V. Ry.
Santa Fe Pac. R. R. Co. The S. K. Ry. Co. of Tex.
Santa Fe Oil Wells, Mar. 19th, 1902.

Mr. Ed. North,
Los Angeles.

Friend Edward:

Yours of the 15th ins't at hand and in reply would say that your 7" underreamer in so far as we have used it, is a "Joe Dandy" and I don't know what more to say about it.

Yours truly,

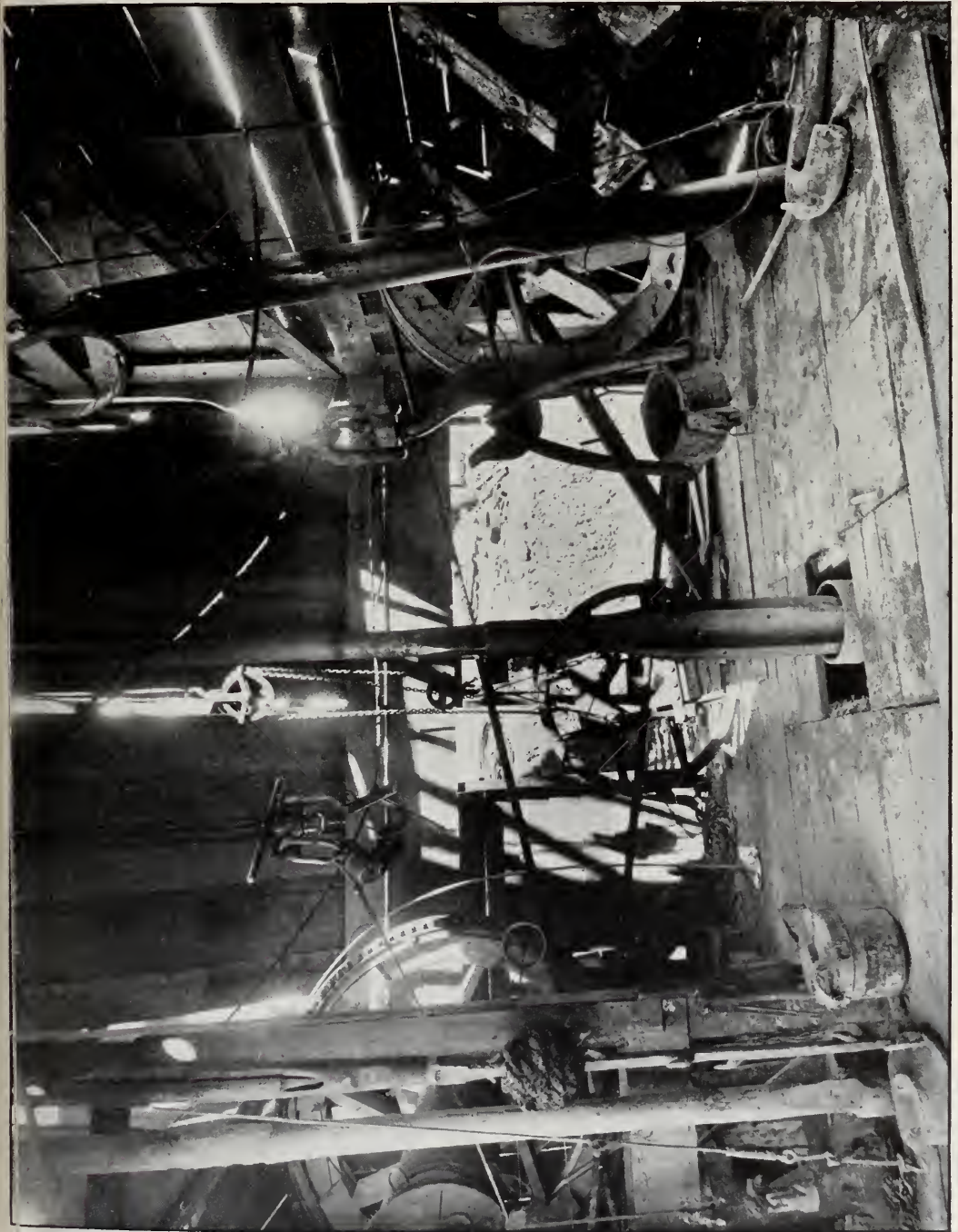
MARTIN BARBER,

Foreman, Santa Fe Oil Wells, Fullerton, Calif.

[Endorsed]: U. S. Dist. Court, So. Dist. Cal., So. Div. No. 1540. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit Letter of March 19, 1902, Martin Barber to Edward North." Leo. Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Letter of March 19, 1902, Martin Barber to Edward North. Filed May 8, 1917. F. D. Monekton, Clerk.

Defendant's Exhibit Photograph of California Oil Well Rig Showing Calf-wheel, Bull-wheel, Wire Rope and Top of Casing in Hole, the Casing Shown Being Heavy Casing Weighing not Less Than 54 Pounds to the Foot.



[Endorsed]: U. S. Dist. Ct., So. Dist. Cal., So. Div. No. 1540—Equity. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. Defendant's Exhibit Photograph of California Oil Well Rig Showing Calf-wheel, Bull-wheel, Wire Rope and Top of Casing in Hole, the Casing Shown Being Heavy Casing Weighing Not Less Than 54 Pounds to the Foot. Leo. Longley, Spl. Exr. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Photograph of California Oil Well Rig Showing Calf-wheel, Bull-wheel, Wire Rope and Top of Casing in Hole, the Casing Shown Being Heavy Casing Weighing Not Less Than 54 Pounds to the Foot. Filed May 8, 1917. F. D. Monckton, Clerk.

Defendant's Exhibit Wilson Underreamer Patent.

[Endorsed]: U. S. Dist. Court, So. Dist. of Cal., Southern Division. No. 1540. Union Tool Co. et al. vs. Wilson & Willard Mfg. Co. "Defendant's Exhibit Wilson Underreamer Patent." Leo Longley, Special Examiner. Filed Apr. 16, 1913. Wm. M. Van Dyke, Clerk. By Chas. N. Williams, Deputy Clerk.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Deft's. Exhibit Wilson Underreamer Patent. Filed May 8, 1917. F. D. Monckton, Clerk.

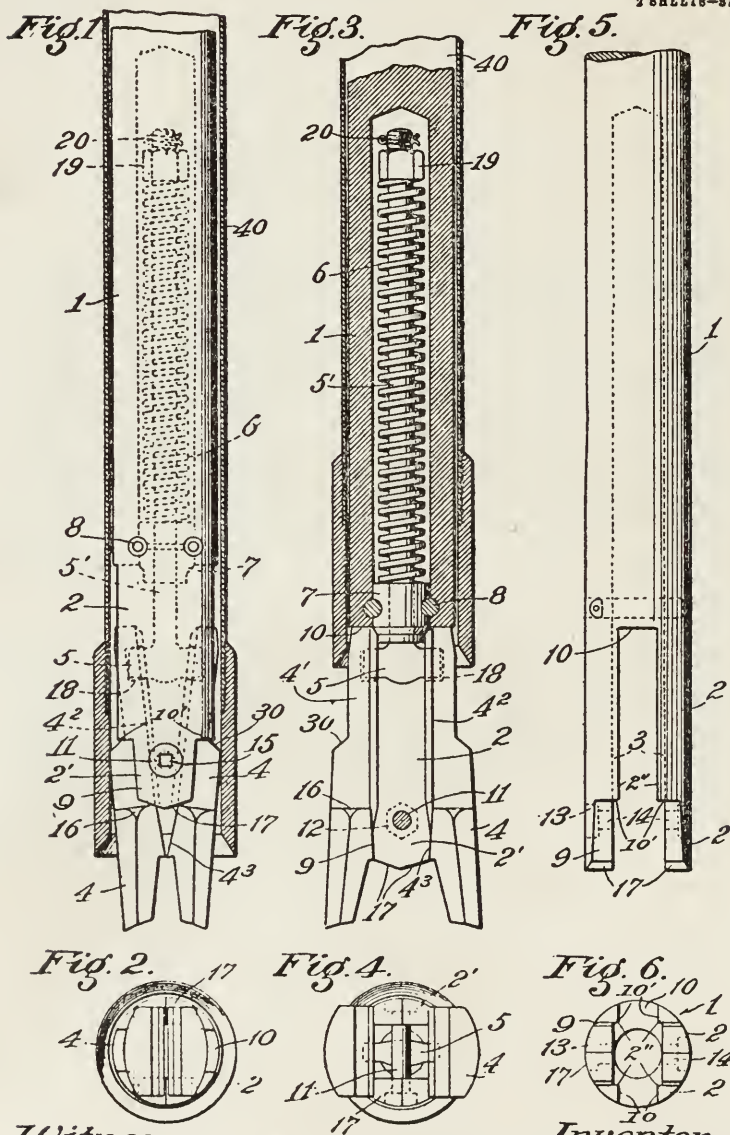
No. 827,595.

PATENTED JULY 31, 1906.

E. C. WILSON.
UNDERREAMER.

APPLICATION FILED NOV. 28, 1905.

2 SHEETS—SHEET 1.



Witnesses:
E. C. Hollis
C. J. Williams

Inventor,
Elihu C. Wilson
by James R. Townsend
his atty

No. 827,595.

PATENTED JULY 31, 1906.

E. C. WILSON.
UNDERREAMER.

APPLICATION FILED NOV. 28, 1905.

2 SHEETS—SHEET 1.

Fig. 7.

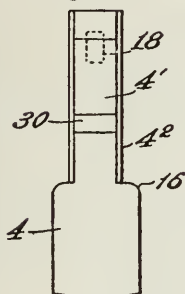


Fig. 8.

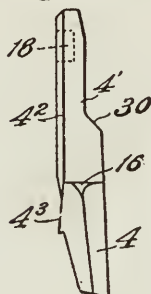


Fig. 9.

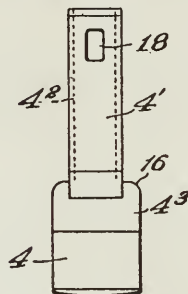


Fig. 10.

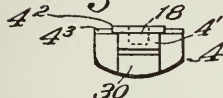


Fig. 11.

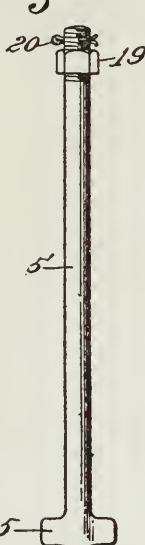


Fig. 12.



Fig. 13.



Fig. 14.



Witnesses:.

C. C. Holly,
C. J. Williams

Inventor,

Elihu C. Wilson.

By James P. Townsend
his Atty

UNITED STATES PATENT OFFICE.

ELIHU C. WILSON, OF BAKERSFIELD, CALIFORNIA.

UNDERREAMER.

No. 827,595.

Specification of Letters Patent.

Patented July 31, 1906.

Application filed November 28, 1905. Serial No. 289,380.

To all whom it may concern:

Be it known that I, ELIHU C. WILSON, a citizen of the United States, residing at Bakersfield, in the county of Kern and State of California, have invented a new and useful Underreamer, of which the follow is a specification.

Objects of this invention are to provide an underreamer of superior strength and of superior width and expansion of cutters so as to enable reaming as great a portion of the circumference of the hole as possible at each stroke, to insure greater safety against losing the cutters from the body while reaming, to avoid the necessity of a middle joint in the mandrel or reamer body, and to leave a maximum open space between the cutters to receive the loose material or sludge at the bottom of the well or other opening during the operation of drilling.

By this invention it is possible to increase the strength of the cross or T which suspends the cutters.

In this invention a cross or T formed of a single forging is provided for suspending the cutters.

Another decided advantage is simplicity and convenience of attaching and removing the cutters and suspending devices from the reamer-body.

Another advantage is facility of collapsing the cutters. I so construct the mouth of the underreamer as to dispense with stock between the collapsed cutters, thus enabling the cutters to close together. This feature makes extreme expansion possible and makes the use of maximum amount of stock in shanks of cutters possible, thus insuring maximum strength of cutters.

The accompanying drawings illustrate the invention.

Figure 1 is a view of the underreamer in a casing just before it has passed through the shoe of the casing, the parts being collapsed. Fig. 2 is a view looking at the bottom of Fig. 1. Fig. 3 is a view of this newly-invented underreamer in a well, the same having just passed through the casing-shoe and expanded for reaming the hole below. Portions are shown in mid-section. Fig. 4 is a view looking at the bottom of Fig. 3. Fig. 5 is a view of the reamer-body at right angles to Figs. 1 and 2. Fig. 6 is a view looking at the bottom of Fig. 5. Fig. 7 is a front view of a cutter detached. Fig. 8 is an edge view of a cutter at right angles to Fig. 7. Fig. 9 is a

view of the inside or back of the cutter. Fig. 10 is a view looking down on the top of the cutter. Fig. 11 is a view of the cross. Fig. 12 is a view of the cross at right angles to Fig. 11. Fig. 13 is a side view of the spring seat-block detached. Fig. 14 is a bottom view of the same.

1 designates a hollow body of an underreamer terminating in prongs 2, forming a fork, said prongs having shoulders 2" on their inner faces to form ways 3 for cutters. Said prongs are provided with and terminate in downwardly-projecting lugs 2' to spread the cutters apart.

4 designates the cutters, which are interchangeable; 4', the cutter-shank; 4², bearing-shoulders of the cutters to engage inside the ways 3; 4³, expansion bearing-faces of the cutters on the sides of said cutters.

The inner faces of the prongs 2 are parallel, and the sides or shoulders 2", which form the ways 3, are also parallel. The cutter-shank 4' and its bearing-shoulders 4² are straight—that is to say, the sides or edges thereof are parallel and fit the ways 3.

5 is a cross 5' the stem of the cross, and 6 the spring which actuates the cross. The parts 5 5' constitute spring-actuated means for actuating the cutters to expand the same.

7 is a block forming a seat for the spring 6. One or more dowel-pins 8 may be provided as means for holding the block or spring-seat 7 in place.

9 designates the spreading bearings for holding the cutters 4 apart, and 10 the down thrust bearings for the cutters. The down thrust bearings 10' are in the nature of shoulders formed by the edges of the forks at the base of the lugs 2'. The prongs 2 of the body are of substantially one thickness throughout, excepting that they are reduced at their lower ends to form lugs for spreading the cutters 4 apart. The edges of the lugs 2' for the spreading bearings 9 and the prongs terminate abruptly in the shoulders 10' at the base of the lugs 2". This construction affords the necessary operative structure with maximum strength for minimum weight of body.

11 is a detachable cross-piece in the form of a bolt secured by a nut 12. 13 is an angular socket in the outer face of one of the fork around the bolt-hole 14 in said fork. The nut 12 is conformed to the angular socket and the bolt 11 is provided with an angular socket 15 in its head to receive a wrench (not shown) for screwing the bolt into the nut.

827,595

The expansion bearing-faces 4³ terminate at their upper ends in rounded corners or bearings 16 to ride more readily over the beveled end faces 17 of the downwardly-projecting lugs 2' to engage said bearings for expanding the cutters.

18 designates recesses in the inner faces of the cutters for engaging the ends of the cross 5.

19 and 20 indicate the usual tension-nut for the spring 6 and the cotter-pin for securing the same.

To assemble the underreamer, the block 7 will first be placed on the stem 5' of the cross 5, and the spring 6 is then adjusted and secured in place by the nut 19 and cotter-pin 20. Then the cutters are placed on the ends, respectively, of the cross 5, which seat in the recesses 18 therefor. Then the parts thus assembled are inserted into the hollow mandrel and brought into the position shown in Fig. 3, whereupon the dowel-pins 8 are inserted and the cross-piece formed of the bolt 11 is then inserted. The nut 12 is placed in its angular socket 13, and the bolt or cross-piece 11 is then screwed home. The underreamer is then in condition for operation.

To use the underreamer, the cutters will be drawn down below the downwardly-projecting lugs 2', thus collapsing the same into the position shown in Fig. 1, whereupon the underreamer will be inserted into the pipe or casing in the usual manner and allowed to descend. When it has passed through the hole, as shown in Fig. 3, the spring operates in the usual manner to draw the cross 5 up, thus bringing the cutters into the expanded position shown in Fig. 3. The rounded shoulders 16 ride readily over the beveled faces 17, and the upper ends of the cutters seat against the downthrust bearings 10, and the bearing-shoulders 4² of the cutters engage the ways 3 of the fork prongs or members 2, thereby being solidly held during the operation of underreaming. The spreading bearings 9 of the lugs 2' engage the expansion bearing-faces 4³ of the cutters at the same time, so that the tool is practically a unit during the operation of underreaming.

30 designates the usual shoulders on the cutters for drawing the same in when the tool is removed through the pipe or casing 40. It is advisable that the lower ends of the forks 2 should not form downthrust bearings for the cutters, as there would otherwise be a tendency of crystallization of said forks, which is avoided by making the downthrust bearings at 10 only.

The cross-piece 11 serves as a brace for the prongs of the fork and prevents accidental removal of the cutters and T or cross 5.

It is to be noted that by the construction shown the cutters are quickly expanded at the initial upward movement of the same

after escaping the shoe of the casing 40, and that immediately thereafter the cutters are solidly held in the straight and parallel ways 3, and that when the cutters are fully drawn up they seat on the downthrust bearings 10 and the spreading bearings 9, while the shanks are rigidly held throughout their length. Said spreading bearings are on the lugs 2', which constitute wedges for wedging the cutters apart, and said bearings are at the sides of the lower ends of the body, thus engaging the outer edges of the cutters to hold the cutters apart and leaving an open space between the middle portions of the cutters for a greater distance upward from the lower ends of the cutters than would be the case were the cutters held apart by any intermediate portion between the lugs.

I term the cutters "shouldered cutters," for the reason that the rounded corners 16, which extend away from the shank at right angles thereto, are in the nature of shoulders, the inner faces 4³ of which engage the spreading faces 9 of the side lugs 2' to brace the cutters and hold them apart.

What I claim is—

1. An underreamer-body terminating in prongs having projecting lugs at their lower ends with spreading bearings 9 for holding the cutters apart.

2. An underreamer-body terminating in prongs and provided with upper and lower bearings for the cutters, said prongs having projecting lugs, the edges of which form lower bearings for holding the cutters apart, and the ends of said lugs having beveled end faces.

3. An underreamer-body terminating in prongs the inner faces of which are provided with straight parallel ways, the ends of said prongs terminating in lugs below said ways to spread and hold the cutters apart.

4. An underreamer-body terminating in prongs forming a fork, said prongs having shoulders on their inner faces to form ways for the cutters.

5. A hollow underreamer-body terminating in prongs forming a fork having shoulders on the inner faces to form ways for the cutters, cutters in said ways, a cross in said hollow body for operating said cutters, a spring for operating the cross, a block in the body to form a seat for said springs, and one or more dowel-pins securing the block in place.

6. A hollow underreamer-body, cutters, a cross inside the hollow body for operating said cutters, a spring for operating said cross, a block in said body forming a seat for said spring, and one or more dowel-pins for holding the block in place, said block and pins being located entirely above the head of the cross.

7. A hollow underreamer-body terminating in prongs forming a fork and provided with ways and downthrust bearings for cut-

- ters, cutters in said ways engaging said bearings, a cross for operating said cutters, a spring for actuating said cross, a block forming a guide for the stem of the cross and a seat for the cross-actuating spring, its lower end terminating above the head of the cross and projecting below the downthrust bearings to hold the upper ends of the cutters apart, and means for holding the block in the reamer-body.
8. A hollow underreamer-body terminating in prongs forming a fork, said prongs having shoulders on their inner faces to form ways, cutters in said ways, means for operating the cutters, and a detachable cross-piece connecting the ends of the fork.
9. An underreamer-body terminating in prongs forming a fork and provided with shoulders on the inner faces of the prongs which form cutter-ways and terminate in downward-projecting lugs, and, cutters mounted between the prongs of said fork and having shoulders inside the fork and faces to bear on the projecting lugs.
10. An underreamer-body terminating in prongs having projecting lugs at their lower ends to hold the cutters apart.
11. An underreamer-body terminating in prongs forming a fork having beveled faces at the ends of its prongs, cutters having shoulders to ride over said beveled faces, and means for suspending said cutters in said body.
12. An underreamer-body terminating in prongs forming a fork, the ends of said prongs being provided with lugs to spread the cutters apart.
13. An underreamer-body terminating in prongs forming a fork, said prongs having shoulders on the inner faces to form ways for the cutters, and said prongs terminating in lugs to act as spreaders for the cutters.
14. A hollow underreamer-body terminating in prongs forming a fork, said prongs terminating in lugs for spreading the cutters, said lugs having beveled ends to engage bearings on cutters to expand cutters.
15. An underreamer-body terminating in prongs forming a fork, said prongs terminating in lugs or projections, said lugs having beveled faces or bearings to expand the cutters, and also faces or bearings for the cutters to rest on after they have expanded to a normal position for reaming.
16. An underreamer-cutter having two shoulders and a bearing-face on the inner side of each of the two shoulders of the cutter.
17. An underreamer-cutter having a shank and a shoulder on either side of the shank of the cutter, each of said shoulders projecting at right angles to the shank of the cutter and having a bearing-face on its inner side.
18. An underreamer having a body terminating in a fork, and cutters suspended between the prongs of the fork, the ends of said prongs constituting wedges to wedge between the cutters.
19. An underreamer comprising a body terminating in two prongs, and cutters each having two shoulders and a bearing-face on the inner side of each of the two shoulders to engage said prongs.
20. An underreamer comprising a body terminating in prongs the inner faces of which are provided with straight parallel ways, and cutters having straight shanks fitting said ways, the ends of said prongs terminating in lugs below said ways to spread and hold the cutters apart.
- In testimony whereof I have hereunto set my hand at Bakersfield, California, this 20th day of November, 1905.
- ELIHU C. WILSON.
- In presence of—
H. I. TUPMAN,
T. E. KLOPSTEIN.

**Defendant's Exhibit Specifications of U. S. Brown's
687,296.**

[Endorsed]: C. C. 1540. Union Tool Co vs. Willard & Wilson Mfg. Co. "Defts. Ex. Specifications of U. S. Brown Patent 687,296." Filed Feb. 24, 1916. Wm. M. Van Dyke, Clerk. Floyd S. Fisk, Deputy.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Specifications of U. S. Brown's 687,296. Filed May 8, 1917. F. D. Monekton, Clerk.

No. 687,298.

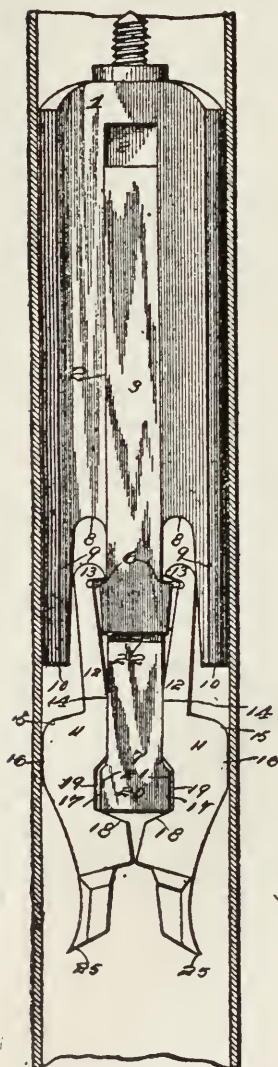
Patented Nov. 26, 1901.

J. S. BROWN.

REAMING TOOL.

(Application filed Apr. 28, 1901.)

(No Model.)



Witnesses

Fig. 1.

Chas. S. Hoyer

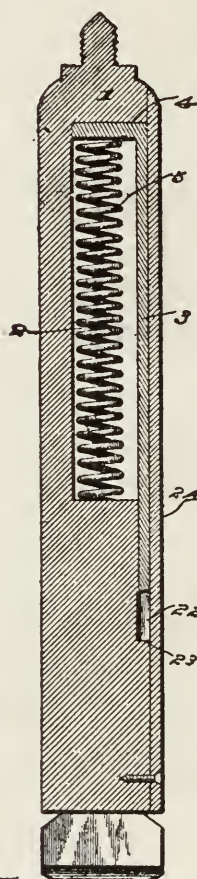


Fig. 3.

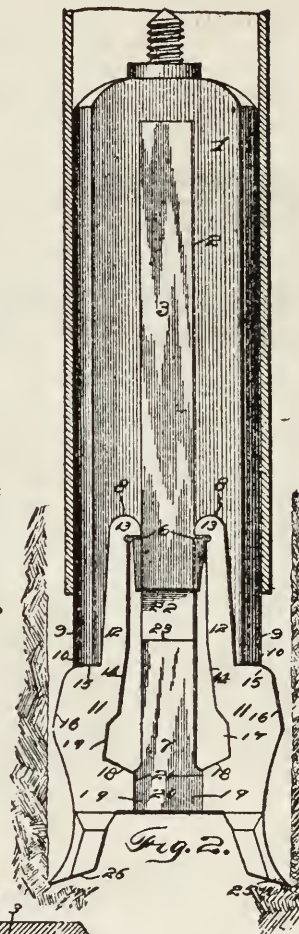


Fig. 2.

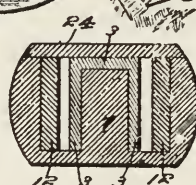


Fig. 4.

J. S. Brown, Inventor.
by C. A. Snow & Co.
Attorneys

UNITED STATES PATENT OFFICE.

JACOB S. BROWN, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO FRIEDRICH EICHENHOFER, OF LOS ANGELES, CALIFORNIA.

REAMING-TOOL.

SPECIFICATION forming part of Letters Patent No. 687,296, dated November 26, 1901.

Application filed April 25, 1901. Serial No. 57,427. (No model.)

To all whom it may concern:

Be it known that I, JACOB S. BROWN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Reaming-Tool, of which the following is a specification.

This invention relates to a reaming-tool for use with a string of well-drilling tools in forming oil or other wells; and the object of the same is to provide an automatically-operating attachment that will contract to pass through a casing-section and when liberated from the lower ends of the latter expand to drill or cut a hole ahead of the said lower end of the casing large enough to let the casing follow.

The invention consists in the construction and arrangement of the several parts, which will be more fully hereinafter described and claimed.

In the drawings, Figure 1 is a transverse vertical section through a portion of a well-casing, showing the improved device in elevation passing therethrough in contracted condition. Fig. 2 is a similar view showing the improved device as having reached the end of the casing and far enough projected therefrom to permit the reaming members to expand. Fig. 3 is a transverse section on the line 2 2, Fig. 2. Fig. 4 is a cross-section on the line 4 4, Fig. 2.

Similar numerals of reference are employed to indicate corresponding parts in the several views.

The numeral 1 designates a stock of suitable dimensions, having an upper reduced screw-threaded attaching end and a longitudinal spring-chamber 2, which is closed by a slide 3, having an angular end 4 extending into said chamber to receive the impact of the upper extremity of a spring 5, located in said chamber, said spring having its lower extremity bearing against the lower end wall of the chamber. The lower end of the slide is formed with lateral catch projections 6, and said slide has longitudinal movement over a central depending partition-bar 7, forming an integral portion of the stock. The lower portion of the stock is formed with recesses 8 on opposite sides of the bar 7 to pro-

vide depending vertical extensions 9 with shoulders 10 at their lower terminals. In the recesses 8 expanding jaws or reamers 11 are mounted and have upper reduced shanks 12, located and having longitudinal movement in the vertical extensions 9 of the recesses, and provided with inwardly-projecting shouldered heads 13 to engage the catch projections 6 of the slide. The inner edges of the shanks 12 where they run into the main body portions of the reamers have downward and outward inclines or beveled portions 14 to cause them to fit close against the opposite side edges of the bar 7 when the reamers are closed in, as shown by Fig. 1, and the upper portions of the bodies of the reamers have angular shoulders 15 to contact with the shoulders 10 to limit the expanding movement of the reamers when the latter are free to fly out into working position. The outer edges of the reamers immediately below the shoulders 15 thereof have outward and downward inclines 16 to contact with the well casing or tube through which they pass, and thereby have the minimum transverse extent of the reamers when in closed position equal to the transverse or cross extent of the stock, whereby the reamers will be caused to freely slide through the casing or tube. To aid in this minimum contraction of the reamers, the inner portions thereof below the inclines or beveled portions 14 are formed with recesses 17, having lower downwardly and inwardly inclined walls 18 at an angle to inner vertical bearing-faces 19, extending to the lower terminals of the reamers. The lower extremity of the bar 7 is formed with a head 20, having opposite side straight edges 21, against which the faces 19 have bearing to hold the reamers firmly out in reaming position, as shown by Fig. 2. When the reamers are contracted to pass through a casing or tube, the recesses 17 receive the head 20 and the lower inclined walls 18 are below the lower end of and partially in contact with the said head, so that the reamers will easily clear the head without sticking when in position to fly out into reaming condition. The slide 3 also has a guide-socket 22 at its lower end, as more clearly shown by Fig. 4, to steady its movement over the bar 7, the latter having a shoulder 23 to limit the down

ward movement of the said socket and slide. The spring and slide, as well as the upper shank portions of the reamers, are normally covered and made accessible by the use of a cover-plate 24, removably attached to the stock, as shown by Fig. 3, said plate being removed in Figs. 1 and 2 to give full view to the parts. The lower ends of the reamers are provided with suitable reaming-bits 25, which flare outwardly, as shown.

It will be seen that the bar 7 centrally depends from the stock and that the reaming-tools are carried by the slide 3 and movable in close relation to the said bar. Hence the bar from its construction operates to spread the reaming-tools when the slide is moved upwardly into the stock and holds the said reaming-tools in positively-expanded working positions, as clearly shown by Fig. 2.

From the foregoing description the operation and advantages of the improved device will be obvious, and by the use of the same in proper position in connection with drilling-tools the application and reliable positioning of the tubes or casings will be facilitated. The improved device is also strong and durable and comparatively inexpensive in the cost of construction. The shanks of the reamers may be readily detached from the slide at any time desired for the purpose of repair or replacement without removing pivots or other fastening devices.

Having thus described the invention, what is claimed as new is—

1. In a reaming attachment of the class set forth, the combination of a stock having a bar centrally projecting from the lower end thereof and recesses on opposite sides of said bar, an automatically-operating slide mounted in the center of the stock and movable over a portion of the said bar, and reaming-tools loosely and freely detachably held at their upper ends in the upper portions of the

recesses on opposite sides of the bar and connected to the lower end of the slide.

2. In a reaming attachment of the class set forth, the combination of a stock having a bar projecting from the lower end thereof and recesses adjacent to said bar, the latter having a lower enlarged end or head, a spring-actuated slide movable longitudinally of the stock and having the lower portion thereof engaging the said bar, the recesses of the stock providing opposite shoulders, and reamer loosely and detachably connected to the slide and having portions to engage the said shoulders and the lower enlarged end or head of the bar.

3. In a reaming attachment of the class set forth, the combination of a stock having recesses and shoulders at the lower portion thereof, a bar depending centrally from said stock and provided with a lower enlarged end with straight side edge portions, a spring-actuated slide mounted in the stock and engaging the said bar, and reamers having shanks loosely and readily and detachably engaging the said slide and provided with inner edge recesses, inclines and straight bearing portions, and outer shoulders and inclines, the portions of the reamers connected to the slide being in the form of shanks reduced in cross-section, the side edge portions of the lower enlarged end of the bar being adapted to engage the straight bearing portions of the reamers and the recesses of the latter having inclined walls fitting over and inclosing the enlarged end of the bar when said reamers are contracted.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JACOB S. BROWN.

Witnesses:

W. EDGAR MILLER,
CHAS. H. TOLL.

**Defendant's Exhibit Certified Digest of Patent
Office Records—Re Brown Patent.**

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE.

To all persons to whom these presents shall come,
Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the Digest of this Office of all Assignments, Agreements, Licenses, Powers of Attorney, and other instruments of writing, found of record up to and including June 5, 1915, that may affect LETTERS PATENT granted to

Edward Double, Santa Paula, Cal.

[Patent No. 734,833.]

Dated July 28, 1903.

“Underreamer.”

Searched from October 9, 1899.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this twenty-first day of June —, in the year of our Lord one thousand nine hundred and fifteen and of the Independence of the United States of America the one hundred and thirty-ninth.

[Seal]

J. T. NEWTON,

Acting Commissioner of Patents.

[Ten Cent U. S. Revenue Stamp. Canceled June
22, 1915. U. S. Patent Office.]

1.

Edward Double

Instrument dated Feb. 4, 1902. Recorded Feb. 2,
1903. Liber H. 66, p. 495.

Parties.

Invention.

Edward Double

Under Reamers.

to

Filed Oct. 26, 1901, Ser.

Union Oil Tool Company,

No. 80,144.

Corporation of Califor-
nia, Santa Paula, Cal.

Pat. 734,833, July 28,
1903.

Double grants to said Company for its sole use, the right to manufacture, use and sell said invention, and hereby sets over to said Company an undivided one-half of the legal title to said invention and letters patent therefor; intending that said Company shall at all times retain said right to manufacture, use and sell said Under Reamers, but may transfer said legal title. Consideration \$20.

Instrument dated Jan. 16, 1903. Recorded Feb. 2,
1903. Liber H. 66, p. 496.

Parties. (Acknowledged

Invention.

Same Jan. 24, 1903.)

Under Reamers.

to

Filed Oct. 26, 1901. Ser.

Same

No. 80,144.

Allowed Jan. 5, 1903.

Pat. 734,833, July 28,
1903.

Filed Oct. 13, 1902. Ser.

No. 127,171.

Pat. 748,054, Dec. 29-03.

Filed Dec. 18, 1902. Ser.

No. 135,792.

Pat. 796,197, Aug. 1, 1905.

In consideration of covenants and agreement herein contained, Double grants said Company license to make, use and vend to others to be used, Under Reamers embodying said inventions, upon terms and conditions herein recited. Mutually agree that if Double shall cease to be connected with said Company as stockholder and officer thereof, the license herein granted shall cease to be exclusive, but said Company shall not be deprived of a right to make such Under Reamers or relieved from payment of royalty as herein provided. The license herein granted is indivisible and said Company shall not grant any license to make Under Reamers under said letters patent without Double's consent. The royalty provisions hereof shall be in effect from January 1, 1903.

Instrument dated Feb. 4, 1902. Recorded Nov. 3, 1903. Liber A. 68, p. 402.

Parties (Acknowledged Invention.

Feb. 14, 1902.) Under Reamers.

Union Oil Tool Company, Filed Oct. 26, 1901. Ser.

to No. 80,144.

Frederick Eichenhofer, Pat. 734,833, July 28,

Geo. C. Gilson, 1903.

Geo. L. Chadderdon,

Los Angeles Co., Cal.

An undivided one-half interest in said invention and letters patent to be issued therefor. Considera-

290 *Wilson & Willard Manufacturing Company*

recorded November 3, 1903, in Liber A, 68 of Transfers of Patents, at
pages 398 and 400 respectively—

tion \$10. (This deed is attached to two deeds A
~~digested in B. 34 of Digest, page 133,~~ Jacob S.
Brown, Inventor.)

Jacob S. Brown.

Instrument dated Feb. 4, 1902. Recorded Nov. 3,
1903. Liber A. 68, p. 398.

Parties (Acknowledged Invention.

Feb. 12, 1902.) Reaming-Tool.

Friedrick Eichenhofer,

Geo. C. Gilson, Nov. 26, 1901. 687,296.

Geo. L. Chadderdon

to

The Union Oil Tool Com-
pany.

An undivided one-half interest in said invention
and letters patent.

2.

Jacob S. Brown.

Consideration recited (This deed is prefixed to
recorded November 3, 1903, in Liber A, 68, page 402, of Transfers of
Patents.

deed following ~~on Digest,~~ and to deed A ~~digested in~~
~~D. 16 of Digest, page 25, first entry under~~ Edward
Double, Inventor.

Instrument dated Feb. 4, 1902. Recorded Nov. 3,
1903. Liber A. 68, p. 400.

Parties (Acknowledged Invention.

Feb. 12 and 14, 1902.) Reaming-Tool.

Same Nov. 26, 1901. 687,296.

to also Edward Double.

Union Oil Tool Company, Under Reamers.

Corporation, Appln. Ser. No. 80,144.

Santa Paula, Cal.

Pat. 734,833. July 28,
1903.

Including Royalty Agreement.

This deed states that said Licensors this day assigned to said Company an undivided one-half interest in said invention and patent 687,296; and that said Company under assignment from Edward Double of his application 80,144, has this day assigned to said Licensors an undivided one-half interest in said invention of Double. Said Licensors hereby grant to said Company exclusive right to manufacture, supply demand for and sell anywhere in the United States of America, said reaming tool covered by patent 687,296, subject to payment of royalty herein recited for all reaming tools hereafter manufactured by said Company, either under patent 687,296 or said invention of Double, or both. This agreement shall be binding upon the heirs, administrators, executors and assigns of the respective parties hereto. Consideration \$1. By each to the other paid. (This deed is annexed to deed pre-recorded November 3, 1903, in Liber A, 68, page 402, of Transfers of ^{Patents} ~~ceding on Digest,~~ and prefixed to deed A ~~digested in~~ ^{D. 16 of Digest, page 25, first entry under} Edward Double, Inventor.)

Instrument dated Nov. 7, 1903. Recorded Nov. 12, 1903. Liber Z. 67, p. 498.

Parties.	Invention.
Geo. C. Gilson,	Reaming Tools.
to	Nov. 26, 1901. 687,296.
Union Oil Tool Company	and Edward Double.
	Underreamers.

July 28, 1903. 734,833,
and other inventions in
Underreamers.

Not specifically identified.

Gilson states that he owns certain interests in said patents and certain other inventions of Edward Double in Underreamers; and of any interest in license contract and agreement dated February 4, 1902, between Friedrich Eichenhofer, George C. Gilson and George L. Chadderdon, and said Company. Gilson hereby assigns to said Company, its successors and assigns, all his right, title and interest in said letters patent, and his right, title and interest, claim and demand in said license agreement; his said interest in license contract being a one-quarter interest in all royalties accruing thereunder, and all rights secured to said Eichenhofer, Gilson and Chadderdon by said license contract and the transactions and assignments forming part thereof, including in the rights so transferred to said Company, all his right, title, interest, claim and demand in any claim or claims for past infringement of said letters patent; intending hereby that said Company shall succeed to all his right, title and interest in said letters patent and under said license contract. Con-

3.

Jacob S. Brown.

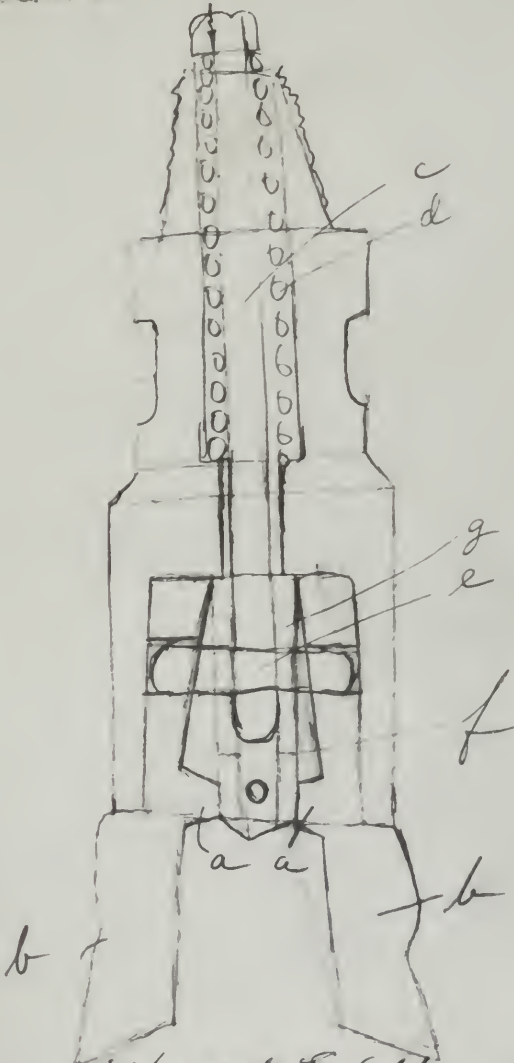
sideration \$500. and agreement by said Company, as herein recited.

[Endorsed]: Defendant's Exhibit Certified Digest of Patent Office Records—Re Brown. Patent Filed Feb. 26, 1916. Wm. M. Van Dyke, Clerk. T. F. Green, Deputy.

No. 2996. U. S. Circuit Court of Appeals for the Ninth Circuit. Defendant's Exhibit Certified Digest of Patent Office Records—Re Brown Patent. Filed May 8, 1917. F. D. Monckton, Clerk.

Case No. 2996U. S. Circuit Court of Appeals
For the Ninth CircuitDefendants Exhibit Double Reamer Pencil
Sketch by Edw. SouthFiled MAY - 8 1917

F. D. McArthur, Jr.



Defendants Exhibit

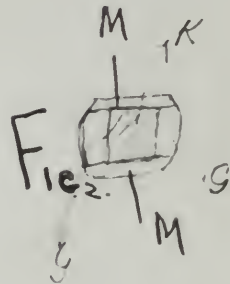
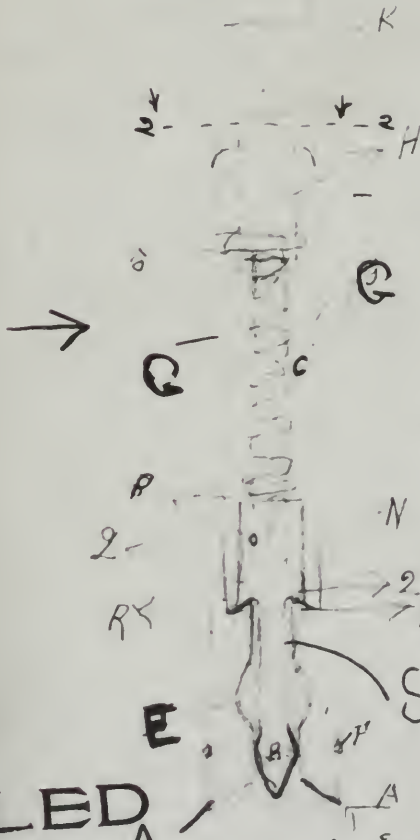
Double Reamer pencil sketch - by Edward
South - 1916 = apt. having July 26 - 1916**FILED**

FEB 26 1916

Wm. M. Van Dyke, Clerk
J. F. Hume, Deputy

Edwards &
 Edwards & Edwards
 of Day
 Reamer

FIG 1



Case No. 2996

U. S. Circuit Court of Appeals
 For the Ninth Circuit

Defendants: Edwards & Edwards
of Day Reamer

Filed MAY - 8 1917

F. D. MONCKTON, Clerk

FILED

APR 16 1913

A

WM. M. VAN DYKE, Clerk
 By Wm. M. Van Dyke
 Deputy Clerk

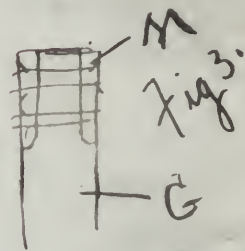
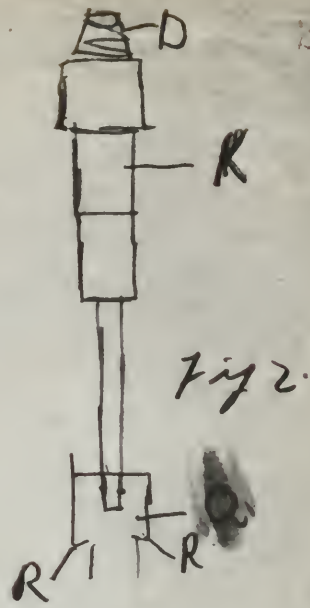
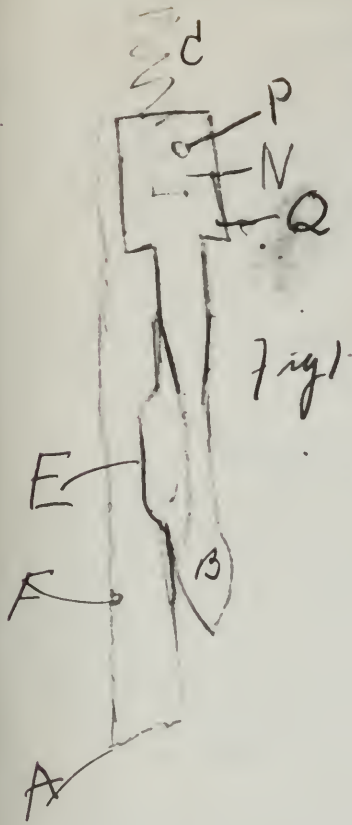
In Equity:
 United States District Court,
 Southern District of California
 Southern Division.
 Union Tool Company, et al.,
 Complainants,
 vs.
 Wilson & Willard Manufacturing
 Company, Defendant.

Certified:-

Genevieve S. Doneline

NOTARY PUBLIC IN AND FOR THE CITY AND COUNTY
 OF SAN FRANCISCO, STATE OF CALIFORNIA

713



FILED

APR 16 1913

WM. M. VAN DYKE, Clerk

By *Charles Williams* Deputy Clerk

Case No. 2996

S. Circuit Court of Appeals
For the Ninth Circuit

Eastwood Partial
Sketch of Day Reamer
Filed MAY 28 1917

F. D. MANCKTON, Clerk

Lefts &
Eastwood
Partial Sketch
of Day Reamer

In Equity
United States District Court, Southern
District of California, Southern
Division

Union Tool Company, et al.,
Complainants,

Wilson & Willard Manufacturing
Company, Defendant.

Certified: - *Samuel S. Donahue*
Notary Public in and for the City and County
of San Francisco State of California

214

*United States Circuit Court of Appeals for the
Ninth Circuit.*

No. 2996.

WILSON & WILLARD MANUFACTURING
COMPANY, a Corporation,

Appellant,

vs.

UNION TOOL COMPANY, a Corporation, et al.,
Appellees.

Designation Under Rule 23.

Agreeably to the provisions of Subdivision 8 of Rule 23, of the Rules of Practice of this Court, the original exhibit marked "Oil Well Supply Co., Pittsburg, Pa., U. S. A." in red cover nor any part thereof need be printed or reproduced.

San Francisco, California, May 8th, 1917.

RAYMOND IVES BLAKESLEE,

Counsel for the Appellant.

Received a copy of the above designation this 9th day of May, 1917.

FREDERICK S. LYON,

Counsel for Appellees.

[Endorsed]: No. 2996. United States Circuit Court of Appeals for the Ninth Circuit. Wilson & Willard Mfg. Co. vs. Union Tool Company. Designation Under Rule 23. Filed May 10, 1917. F. D. Monckton, Clerk.

[Endorsed]: Printed Book of Exhibits. Filed May 26, 1918. F. D. Monckton, Clerk.

